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JOURNAL OF FORESTRY

VOL. 34 JULY, 1936 No. 7

EDITORIAL

REORGANIZATION OBJECTIVES

FUNDAMENTALLY, last month's editorial asserted, the question of jurisdictional authority over federal conservation activities is not whether Secretary Ickes or Secretary Wallace shall have charge of them, but what policies shall govern. That needs substantiation.

When Theodore Roosevelt urged Congress to transfer the forest reserves to the care of the Department of Agriculture, one of the reasons advanced was the association of forestry with agriculture in the governmental structures of other nations. When Gifford Pinchot refused to take charge of the reserves under the Interior Department, his reasons were more concrete. He was convinced that, placed in that environment, he would be foredoomed to failure. Unquestionably he believed that forestry and agriculture were basically akin and belonged together; but various more practical considerations loomed in the foreground.

Time changes many things. Some of the conditions which brought about that decision of nearly forty years ago are no longer the same. The free hand assured Pinchot by Secretary Wilson could not be so free today; the Department of Agriculture, then young, small, and with little hampering centralization, has become much more highly institutionalized, of necessity. And the Interior Department has been modernized; the terrific delays, checks, and lost motion due to antiquated procedures and ill devised organization no longer weight down efficient performance with the oldtime ball and chain. Quite likely Pinchot today would find little to choose between the two Departments in the matter of opportunity to work capably, build rapidly, and get the public business done in a sufficiently business-like way not to lose out.

The question of Departmental attitude is more dubious. Any great permanent organization assumes, as time goes on, an institutional character. It does not readily alter. Under pressure from external forces, it may yield as a tree bends to the storm; when the wind has blown itself out, little lasting impression has been made. Seldom indeed does a Department head leave behind him a radically different institution from that which he took over; his influence is too temporary. By ingrained character and long tradition the Interior Department, as the Land Department of the federal government and as such concerned with executing laws based on the supposed and long unchallenged axiom that resources should be privately owned in order to be developed, was ill fitted for National Forest administration in the formative years when a new policy and attitude had to be worked out and fought for. In the unhesitating judgment

of every chief of the Forest Service down to and including the present time, it has continued to be ill fitted, irrespective of the personality of the Secretary temporarily at its helm. The question is, how well based is this judgment?

Not that the personality of the individual Secretary is unimportant. That was conspicuously shown when Secretary Fall sought administrative control of the Forest Service. He was unwise enough to disclose publicly some of his intentions, in case he obtained the power aimed at. He also made plain that he would begin by putting Greeley out. So violent and disruptive were the changes manifestly imminent if the transfer took place that the West rose up in protest. The specific intentions of other Secretaries into whose hands might come the power to determine who should guide the Forest Service and what course should be steered cannot, of course, be forecast.

Impartial outsiders friendly to the Forest Service sometimes feel that its fears of serious disruption or of radical policy changes following a shift to a new jurisdiction, or of impaired efficiency in the environment which a transfer to the Interior Department would involve, lack reasonableness. This feeling is common amongst members of Congress familiar with what the Forest Service is doing. The organization, they say, is now too firmly established, well esteemed, and internally vigorous not to be certain of carrying on with little difference, wherever placed. Any Departmental head, they feel sure, would give his best effort to furthering the work of the Service as part of his job, and the Service would have no difficulty in demonstrating the soundness of its general policies, winning confidence in its competence, and thus assuring itself of a strong backing. This, however, overlooks certain factors which are involved.

From the transfer of the National Forests to the Department of Agriculture, in 1905, down to March 4, 1933, the latter Department has had seven Secretaries, of whom all but one came from the great agricultural states of the middle West. The seventh (who served only four months) was from West Virginia. During the same 28 years there were nine Secretaries of the Interior. One was from Missouri, one from Ohio, one from Illinois, and one from Massachusetts; their aggregate term was 7 years. The other five were all from the states of the far West, and their aggregate term was 22 years. This was not a fortuitous circumstance. Political considerations assure that the Department of Agriculture is presided over by a Secretary acceptable to the farm interests and nearly always a man from the middle West. A like reason has caused the Interior Department of the past to be predominantly administered by a Secretary acceptable to the business interests of the eleven so-called public land states. Can there be any question as to which of these two Departments has provided the better place for the Forest Service, from the standpoint of affording protection against the pressure of political influences seeking to sway decisions and get policies modified for the advantage of powerful interests in the far West?

Another consideration strengthens the point. The Department of Agriculture has always held strongly for the merit system, and has thus been free from the curse of political appointees subject to political influences. Even its Bureau Chiefs are in the classified civil service. The Interior Department is not equally free from political controls.

All this, however, is matter of past history. Secretary Ickes is honorably ambitious to leave behind him, as a monument to his zeal for conservation combined with extraordinary administrative ability and driving force, and as a landmark in the course of our national development, a reborn as well as rechristened department. By making it the home of all federal conservation work,

and by a drastic remodeling of the old structure and renovation of the old purposes, he doubtless feels he can assure the Forest Service and other units brought into the Department a fit environment and a concentrated public interest in the whole program of conservation too powerful to be disregarded in the selection of his successors. How far may this be true?

There is no certain answer. But the course pursued under his administration of the Department of the Interior in carrying out the Taylor grazing act does not indicate immunity to the influence of powerful western interests in shaping policies of substantial concern to them. Is it probable that the public land states will voluntarily abate their claim to a large voice in deciding who shall head the Department administering the public lands, and what its governing spirit and purposes shall be? Disregard of political considerations of practical expediency has not been a conspicuous characteristic of the New Deal, anywhere. There are elements of safety for the Forest Service in the Department of Agriculture which it is impossible to be sure of in whatever the Interior Department may become.

Nor is this all. While there has been no disclosure as to what course might be taken with respect to present policies of the Forest Service if the transfer should go through, still less as to what organization and personnel changes might be in train, there has been plenty of criticism. At the outset of his conduct of the Interior Department, Secretary Ickes made plain his deep interest in the National Parks. It was then understood that he did not seek control of the National Forests. But between the National Park Service and the Forest Service there are many issues joined. Some of them go deep. Both Services feel that, were the other to have its unhindered way, the results would be crippling. That Secretary Ickes is an ardent backer of the National Park Service has been abundantly evidenced. That he inclines to its viewpoint throughout is not improbable. The National Park Service avowedly seeks jurisdiction over all recreational uses of the National Forests. Were that conceded, consistency would call similarly for transferring the administration of grazing on the Forests to the organization established under the Taylor act. The seriousness of enforced policies leading to such a dismemberment of National Forest administration needs no comment.

No organization which considers itself favorably placed wants to be shifted. It has its roots down—its affiliations, relationships, lines of action and procedure established, its objectives settled. Like a tree, it cannot be transplanted without suffering a material shock. The old roots must largely be cut off and new ones grown. The process is bound to be costly. Much hokum has been spread on the economies realizable through reorganization. On that the public has been led by the nose. The major reason justifying reorganization, where justification exists, is the opening it affords for changing objectives. To the extent that uncertainty exists as to the nature of the changes that will be brought about, reorganization is rightly feared as a leap in the dark.

A communication published in the correspondence department of this issue points out the good work that is being done in the Interior Department in the conservation field. That should not be doubted. We pay high tribute to what our fellow foresters in the Interior Department have accomplished and are accomplishing. More power to them. But it may fairly be asked whether their good work and the support given it by Secretary Ickes is adequate reason for confidence that control of all conservation activities by that Department would in the long run assure the pursuit of the most desirable objectives, throughout.

FORESTRY, PAST AND FUTURE, ON INDIAN RESERVATIONS IN MINNESOTA

By WILLIAM HERITAGE[1]

THE Indian Service is primarily a human service. It deals with every phase of Indian life, from birth to after death. It is necessary many times to do things in a manner not fully acceptable to technical forestry, but necessary in order to care for the human needs. Often it is not possible to force the best practices of forestry on an allotment belonging to some old person who is tottering on the edge of the grave, when, by removing more of the stand than is desirable, we can furnish this person funds with which to buy the necessities of life. However, we can and do practice forestry on tribal lands—that is, on lands held in community ownership—and endeavor to secure the best forestry practices possible on the allotted lands.

Grand Portage Reservation

Today the land situation at Grand Portage is as follows: Some 11,000 acres of allotted land is still under government restrictions. Slightly over 9,000 acres of land originally ceded to the government has now been permanently withdrawn for use of this band of Indians. A land-purchasing crew has been at work on this reservation for the past seven or eight months, and to date have either made purchase or secured options on some 10,000 acres of land. These purchases are being made with federal funds provided by the regular appropriation for the fiscal year 1936 under the provisions of the Reorganization Act of 1934.

Upon completion of the purchases for which we now have funds, approximately three-fourths of the reservation will be under government supervision. While the amount of merchantable timber upon this area is extremely limited we have hopes of being able to secure a small sawmill for the manufacture of possibly one-quarter of a million feet of lumber per annum for the use of this group of three hundred Indians. Approximately 5,000 acres of this reservation, which will be under government control, is in need of planting, and if federal funds continue to be available, we plan on planting these areas within the next five years. However, we do not propose to plant any areas where the cost including stock will exceed $20 per acre.

It is our plan to concentrate the Emergency Conservation Work for the Consolidated Chippewa Agency during 1936 at Grand Portage, and while only a very limited mileage of trails will be built, we will construct such protection improvements as appear necessary on this area. Because of the fact that this area has been denuded by repeated fires, all we can hope to do for many years to come is to give proper fire protection and to plant those areas which will not come in naturally within a reasonable length of time.

White Earth Reservation

On this reservation of approximately 700,000 acres, today only 17,000 acres of restricted Indian land remains, and an area of 8,620 acres of tribal land. There is a large Indian population within the boundaries of this reservation, and the Indian Service is confronted with a difficult problem in caring for these people.

Approximately 40,000 acres of land

[1]Regional Forester, Lake States Region, U. S. Indian Service.

have been optioned and a considerable portion of it paid for by the Submarginal Land Board, later absorbed by the Resettlement Administration. While these lands are purchased for use by the Indians, before such use is authorized it is necessary for certain agreements to be entered into between the Indian Service and the Resettlement Administration covering their use. At the present time this has not been worked out, so we are not in a position to state just what work we will be able to do on this reservation in the future. Our tentative plans for Emergency Conservation Work for the next season provide for the construction of truck trails, telephone lines, and other physical improvements necessary for the proper protection of these lands.

Nett Lake Reservation

Of the original area of 107,000 acres, today the Indian Service has control of about 50,000 acres of restricted Indian allotments. There are approximately 17,000 acres of ceded land which will soon be withdrawn for the permanent use of these Indians, and if Reorganization funds are available in the years to come an effort will be made to block up the greater part of this reservation.

Today 39,524 acres of allotted timberlands are under contract to the Northwest Paper Company, of which some 10,000 acres have been cut over. The volume under contract is approximately 75,000,000 feet. The cut for the past year has been about 16,000,000 feet, including pulpwood.

As all the lands covered by timber contracts are allotted, and for several years prior to the sale the allottees and heirs of allottees had urgently requested the sale of all timber from their allotments, the contracts authorized the removal of the major part of the timber from each allotment. The areas cut over prior to 1934 were either upland areas, on which jack pine or aspen were the predominant species, or swamp area covered principally with black spruce. Practically all of the merchantable material was removed from allotments within these three types. The full estimated value of the timber was paid several years ago when extension of time for cutting was granted on these contracts. The purchaser is anxious to secure from each allotment as much timber as he paid for under a contract made in 1920, when stumpage prices were the highest ever received in the Lake states, and the owners of allotments desire to secure additional payments through the cutting of more timber than was estimated and paid for. However, the so-called "Reorganization Act" of June 18, 1934, directs the Secretary of the Interior to require that all Indian forests be managed on a sustained yield basis, and we have definitely adopted the policy of giving first consideration to the requirements of good silviculture in the cutting on Nett Lake lands. We have been aided in preparing our marking plans by members of the Lake States Forest Experiment Station, and their help has proven of great benefit.

During the past summer we have managed to leave a fair stand for future growth, but this has been injured to some extent by heavy windfall, and to a lesser extent by the sleet storm in November, 1935. We have a very difficult problem because the majority of the pine is overmature and the smaller trees are largely suppressed individuals and in many instances are quite defective. On this sale the pine slash is piled and burned, while the other slash is left as it falls with the exception of clean-ups along the main logging roads and trails. There are a few areas of fair reproduction of pine, and in these we are demanding the most careful logging in order to leave as good a stand as possible. Our marking rules for pine provide for the leaving of at least four scattered seed

trees per acre, if they appear wind-firm, or groups of trees up to twenty in light soil for each area of five acres.

In the jack pine type we do not intend to cut more than 50 per cent of the merchantable volume.

The black spruce presents a difficult problem. We try to reserve up to 15 per cent of the volume of the trees which will produce two 100-inch sticks, and to leave this residual stand in blocks or strips. However, heavy windfall has occurred.

In the areas logged during 1929 to 1932 which contained poplar we have today a heavy growth of poplar, averaging probably 9 feet in height and affording cover which has kept the growth of grass and fire weeds well down, except along the road and railroad right-of-way. Our fire protection plans are fairly well completed at this reservation. The major roads and trails are all built, communication system is complete, and we have four steel lookout towers equipped with proper buildings for use of the observers.

We have also constructed a dam to regulate the water for wild rice culture at Nett Lake.

As soon as the land status of the reservation has been placed in a condition so that we will definitely know what lands we will control, or can hope to control, and funds become available, we will secure data as to the condition of our stands and endeavor to work out some definite plan of management for the future.

Red Lake Indian Reservation and Forest

The Red Lake reservation was diminished to its present size of approximately 400,000 acres in 1903. At present it has a population of 2,000 Indians. The northwestern part of the reservation is almost all muskeg, and while it contains islands of spruce and tamarack with small areas of poplar, there is only a limited amount of merchantable timber within this area. In the late nineties and early 1900 several large timber fires swept part of the reservation. Also, a number of smaller fires ran in from the south and killed timber at various times. This timber was removed under the Dead and Down Act, and the cut amounted to some 56,000,000 feet. The Act of May 18, 1916, set aside 112,000 acres embracing "the Point" and the area south of Red Lake as the Red Lake Indian Forest. This Act provides in part:

"Said forest shall be administered by the Secretary of the Interior in accordance with the principles of scientific forestry with view of production of successive timber crops thereon. . . . . And he is further authorized to construct and operate sawmills for the manufacture of the timber into merchantable products and to employ such persons as he shall find necessary to carry out the purpose of the foregoing provisions, including the establishment of nurseries."

The spring of 1917 was quite dry, and heavy fires occurred in the area south of Red Lake. A large amount of money was spent in endeavoring to control these fires, but with little success, and great damage was done to large areas of mature white and Norway pine. As the Act of 1916 allowed the sale of timber, and it appeared necessary to offer a large block in order to attract operators who could log those scattered, heavily burned areas, all timber in the area south of Red Lake, and extending to a point some three miles west of Sandy River, was offered for sale. Great interest was secured from the lumbermen, and no less than twelve of the large operators within the state carefully examined this block of timber. The International Lumber Company was the successful bidder, at a price of $14.10 per thousand for white pine and $10.25 per thousand for Nor-

way. Especially good prices were also secured for the cedar, and over $90,000 worth of stumpage of this species was removed. The total cut by the International Lumber Company was 105,000,000 feet, from an area of about 40,000 acres, for which a total of $1,400,000 was received.

Since about 1900, the Agency has maintained a small sawmill for cutting lumber for the use of the Indians in home building and for Agency purposes. This mill was originally set up on Shell Lake, and later removed to the Agency at Red Lake. The amount produced per annum was small until after the fires of 1917, when the cut was increased to 2,000,000 feet per year. During 1917 only two fires occurred on "the Point." It is my belief this was due to the fact that the group living on "the Point" have a real personal interest in the protection of their timber. Many of the lumbermen were disappointed that the timber on "the Point" was not offered for sale at the same time as that on the south side. However, Chief Supervisor of Forests, J. P. Kinney, from his first contact with Red Lake, in 1910, had looked forward to the development of a mill which would operate in perpetuity, and he was the man who saved the timber on "the Point." The logging of timber for the Agency mill proceeded on the basis of approximately two million a year until 1924, when authority was secured to use tribal funds for the erection of the present mill at Redby. This mill is located on private lands. However, a long-term lease was secured from the owners. Since the construction of the mill some 38,000,000 feet of timber have been manufactured in this plant.

The financial records of this plant are not bright, largely because of the general business difficulties that have occurred during the past six years. In the early years of the depression the mill was operated in order to furnish labor to this group of people who are largely dependent on this forest. This has resulted in the building up of a large stock of lumber which was held year after year, and, of course, considerable loss occurred in degrading of the stock because of this delay in selling. Today the stock is being moved at a loss. However, this is necessary in order to save greater loss in another year or two.

The early logging on the International Lumber Company sale consisted of the removal of burned timber. When I arrived at Red Lake in the fall of 1919 as Forest Supervisor, operations were commencing in the green timber, and they were continued for two years. Seed trees were marked with the idea of securing a future stand. If sufficient seed trees were not retained, it was because it appeared at the time that a satisfactory stocking would be secured from those we did retain or because trees that appeared wind-firm were not available. When the logging under this contract was resumed in 1926-27, the seed tree method was continued. In all logging since 1918 all slash except cedar has been burned as logging proceeded.

In the autumn of 1930 a wind of cyclonic proportions occurred at Red Lake, and approximately 90 per cent of our seed trees were wind-thrown. A large number of these were so located that we were able to salvage some 2,000,000 feet. This was a body blow to our forestry plans. However, as a period of nine to eleven years had elapsed since the logging on approximately 55 per cent of the area, these seed trees had done excellent work. Only one seed year had occurred between logging and the blow-down on the balance of the area, but one is agreeably surprised with the reproduction found throughout the area today.

In August, 1930, a fire occurred which denuded some 3,000 acres of land south of Redby. The spring of 1931 was an extremely bad fire season, and approxi-

mately 13,000 acres on the area south of the Lake was burned over. In a great part of this area all tree growth was destroyed.

Since Emergency Conservation funds became available we have made a large amount of physical improvements, and today our protection plans are practically completed.

Recently there has been a change in the personnel set-up, and the present mill manager is a trained forester. He will direct not only the milling but also the logging and protection of the forested area, it being believed that, with this coordination between the management and the manufacturing, much better results will be secured than have been possible in the past. The present superintendent of the reservation is also a trained forester. The physical improvements made to the forest will make it possible to change methods of logging. It should be possible to follow a system of selective logging which will produce the stock the market will absorb at a profit.

Our present stand of mature pine is about 65,000,000 feet. There is also a stand of about 52,000,000 feet of jack pine, hardwood, spruce, and poplar available for this mill. It appears that the annual growth within these mature stands should equal about 1,000,000 feet. In addition, the large areas of young stands probably have an annual growth of 2,000,000 feet, giving an indicated annual growth of 3,000,000 feet on the areas serving this mill.

At present we are preparing a management plan. Our data are rather limited. However, with the benefit we are securing from the Lake States Forest Experiment Station we hope to be able to at least prepare a plan which will point to the objectives we hope to reach.

FOREST SEED CONTROL[1]

By HENRY I. BALDWIN[2] and HARDY L. SHIRLEY[3]

The question of origin of seed, or provenience, has been extensively discussed, but much of what has been written seems far removed from the actuality of our planting operations. The purpose of this paper is to bring out what practical steps have been taken in European countries and what has so far been done in the United States toward assuring supplies of forest tree seed from known sources and of desirable character. Ideal control of seed supplies will have to come about gradually, for nowhere is a perfect system in force. It is believed, however, that a few simple reforms in our nursery and planting records can be made at little or no expense, and will prove of great benefit. A brief orientation of the subject is given, followed by an account of how seed origin is controlled in other countries. A succeeding paper will discuss "A Forest Seed Program for the United States."

TREES growing in a given region often differ from individuals of the same species growing in another region in form, color, or inner characteristics. Where these visible differences are pronounced and are inheritable, varieties and sub-species have been described by taxonomists; to the systematist these differences are botanical differences. This aspect of origin control becomes one of trueness to name, and is of chief interest to the horticulturist.

The invisible differences are often more important, although less easy to recognize. Groups of trees in one region differ from those of apparently the same species in another without indication from form or structure, but rather in the way they react to climate and soil, and in relative susceptibility to diseases and insects. These differences seem to be the result of specific adaptation to certain characteristics of local climate as the result of prolonged natural selection, whereby the more perfectly adapted individuals have survived and attained dominance. In rare cases adaptation to certain soils has been indicated. Of all factors air temperature, especially the duration of a certain minimum temperature during certain seasons, seems to be most important. Altitude is probably not important in itself, and affects trees only by its effect on temperature.

These inherent physiological differences, which are more pronounced in some species than in others, shade into one another with as many gradations as do morphological differences and the climates themselves.

Evidences of the Importance of Differences in Origin

A full presentation of the evidence of the importance of local races in reforestation cannot be given here. Reviews of the subject have appeared frequently in the Journal of Forestry in recent years, and in many other places (1). One of the most systematic and complete summaries was published three years ago by Champion (5). Results of indiscriminate use of seed were first recognized in Sweden over 60 years ago (31, 32), but the consequences have been most serious in Germany, due to the extent of artificial regeneration. Very drastic measures became necessary to correct the evil, and therefore the situation in Germany will be given in especial detail.

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[1]Read originally before the New York Section, Society of American Foresters, Albany, N. Y., February 1, 1935, by H. I. Baldwin and issued in mimeographed form by the New York Section, 1935. Revised and augmented in cooperation with H. L. Shirley, January, 1936.

[2]Caroline A. Fox Research and Demonstration Forest, Hillsboro, N. H.

[3]Lake States Forest Experiment Station. (Fellow, Oberlaender Trust, 1935.)

Trees of bad form and undesirable race are rather more often encountered in German forest plantings than those of good race, particularly in those stands which were planted during the period 1890-1910, when foreign importations of seed were most heavy.

That these poor-quality stands are due in large measure to the use of seed from a wrong source or from poor individuals can no longer be doubted, in view of the evidence. The most impressive experiment was started under the auspices of the Union of Forest Experiment Stations in 1906. Lots of Scotch pine cones from 10 different regions were extracted at Eberswalde, Germany, under uniform conditions, and the seed from each locality was divided into aliquots, one of each being furnished to each cooperator. Series of test plantings were made in Sweden, France, Belgium, and Austria, and by the different forest experiment stations and schools in Germany. Reports of the results have been published from time to time. The experiments of Cieslar (6), near Vienna, and of Engler (4, 8), near Zürich, are likewise impressive; they preceded the experiment mentioned above. In all these experiments one sees plants of a single species, but from seed of different origin, growing side by side with those adapted to the site, tall, straight, vigorous and healthy, while those ill-adapted are weak, crooked, limby, and subject to insect and fungal attack. Furthermore, plantings of beech and oak by Oppermann (20), near Copenhagen, have demonstrated that at least to some extent, ill-formed parent trees tend to produce ill-formed offspring.

While Scotch pine is an outstanding example of a tree very sensitive to climatic changes, European black alder (*Alnus glutinosa*) presents a classical example of transmission of characteristics of form from parent to offspring. Good races produce trees 60 or more feet in height with diameters up to from 12 to 18 inches, while the extremely bad races of alder grow very rapidly in early youth, start producing seed in great abundance when they have attained a height of 10 to 15 feet, and are decadent before reaching 20 years of age, producing no merchantable product, not even fuel.

Similar but less striking examples can be drawn from larch, spruce, oak, and other species in Europe. In fact, every European species which either has a wide natural geographic distribution or grows over a wide range of altitudes has exhibited, when tested, racial differences. The same may be said of American trees. So far, investigations have been confined to only a few species; but of those tested, all which in their natural habitats grow in a wide variety of climates show climatic races.

A classical American example is Douglas fir, which has been under investigation in our Forest Experiment Stations for about 25 years. Ponderosa pine is another good example; plants of Black Hills origin have grown well in Nebraska, where those of Rocky Mountain origin proved unsatisfactory (3). Other species known to include geographic races are eastern white spruce, Norway pine, red oak, and green ash. The four conifers just mentioned have been among the most popular for forest planting in America, and green ash will form the backbone for shelterbelt planting in the prairie regions.

Foresters in America are faced today with many of the problems faced about one hundred years ago by early European foresters. Most of our original forest lands have been cut over once or more, and due to the loggers choosing only the trees valuable for timber, much of the land now supports cull timber or second-growth of inferior species. With defective and crooked specimens left as seed bearers, there is even risk of local degeneration of a species. Counties and states are faced with the problem of making these lands productive enough to support the

population left in the wake of the lumber industry, or of providing continual subsidies. Large-scale moving of population has not appeared practical. In Germany this problem was attacked through an extensive program of forest improvement, in which planting of waste lands and conversion of inferior hardwood stands to conifers played an important part, just as American foresters are advocating and actually carrying out a like program on a large scale today. In our program we have the opportunity of utilizing European experience to chart our course around the blunders and pitfalls which so often engulf large-scale programs when some of the fundamentals are neglected.

Seed Control in Germany

In December, 1934, a forest seed law was established in Germany which contains the following provisions (39):

1. Forest owners and managers must, within a time limit set by the Reichs Forester, eliminate stands and individual trees of bad race from their forests.

2. Henceforth only seed from certified forests or stands may be used for propagating certain species of trees.

3. Seeds from cones collected from undesirable stands or trees must not be sold or given away.

4. No compensation is due owners or others for economic loss incurred as a result of the provisions of this law.

5. Infractions are punishable by fines up to RM 10,000 ($4,000) or by imprisonment, or both.

6. The Reichs Forester is charged with making the necessary regulations for carrying out the provisions of this law, and with the administration of the regulations.

When one realizes that roughly half of the forest stands in Germany are of bad race within the interpretation of this law and cannot be certified for seed production, and that probably 50 per cent of these are so bad that they come under the provisions of Section 1, the tremendous magnitude of the effort becomes evident. This law marks the beginning of a determined struggle to eliminate from German forests the weak and unfit, the crooked, limby, or frost-susceptible trees, and to restore the sturdy, straight-shafted native races in so far as possible. When a nation with large areas in forest actually undertakes to root out approximately one-fourth of all its forest trees because they are not worthy of the soil they occupy, trees upon which great effort in labor and money has been expended, to start once more the long, tedious, and expensive process of growing a new forest from seed, it is plain that tragic mistakes have been made in the past.

The early German forest managers, unaware of racial differences within tree species, had naturally directed their patronage in buying seed for forest planting to those regions which could supply the seed most cheaply. Usually these regions were those in which the trees grew in open groves and resembled orchard trees in growth-form and fruitfulness. During the middle of the nineteenth century centers for seed supply developed in the Rhine-Mainz region in Germany and in Austria-Hungary, Belgium, and southern France (34). By 1909 the yearly shipments to Germany from France alone amounted to 130 carloads of Scotch pine cones and 66,000 pounds of seed. But by 1906 many foresters suspected that German forests were being lowered in productivity by the use of improper seed (34). A special committee was appointed by the German forestry society (Deutsche Forstverein) to investigate the question, and in 1911 an organization of owners of nurseries and seed extraction plants was formed to control the source of seed.

Members of this organization discontinued the purchase of foreign seed, but made no attempt to differentiate between different regions within Germany, or between seed from native German trees and that from trees grown from foreign seed.

The inadequacy of the organization was soon realized; but no substantial progress was made until after the war, when the question was taken up anew (30). In 1924 an outline was drawn up by representatives of the interested organizations which laid down the general principles along which seed certification should be carried out. As a direct outgrowth of this the Forest Seed Certification Board (Hauptausschuss für forstliche Saatgutanerkennung) was initiated in 1925.

The constitution of this board provides that the Society of German Foresters (Deutsche Forstverein), the Federal Forestry Council (Reichsforstwirtschaftrat), the German Agricultural Council (Deutsche Landwirtschaftrat) as representative of the Agricultural Chamber (Landwirtschaftkammer), and the Society of German Commercial Seed Extractors and Nurserymen (Vereinigung deutscher Handelsklengen und Forstbaumschulen), shall form a working group for forest seed certification. The actual certification work is carried out through a central executive committee of twelve members appointed for four-year terms with overlapping tenure. This committee has the authority to appoint regional and other special committees responsible to it. The formulation of general rules for seed certification and the division of Germany into climatic regions for certification is also a responsibility of the executive committee.

The details of the organization and the rules for certifying stands are given in three special publications (34, 37, 38). From 1925 to December, 1930, 1,500,000 acres of forests had been certified according to these rules.

To be placed on the list of dealers in certified seed the forest owner is required to allow his stand to be inspected by the regional committee, to furnish information on actual yield of cones from certified stands, to refrain from selling cones or seeds to extractories or nurseries not among the certified group, to supervise the cone collection to make sure that uncertified cones do not become mixed with the selected ones, and to keep accurate account of all certified seed and to whom it is shipped. Special labels and lead seals are provided for certified cones and seed. The maps of the certified stands are kept in the office of the organization, and in case only a part of a forest is certified, the boundaries of the actual stands are marked out on the ground by rings painted on the trees.

Seed extractories and nurseries are required to keep certified products separate and accurately labeled, to buy certified cones or seed only from certified dealers, and to advise the regional committee of all sales of certified products. The names of firms dealing in certified products are published at the beginning of the cone harvest each year, along with the names of firms which have been removed from the certified list. In order to insure compliance with regulations the executive committee requires certified firms to furnish bonds of RM 10,000 ($4,000) for extractories and RM 5,000 ($2,000) for nurseries. These bonds are to expire at the end of five years if the firm has complied completely with its obligations. Extractories are further required to keep a book showing all receipts and sales of certified wares. All certified dealers are required to submit to inspection by the committee, and in event of infractions, either wilful or due to carelessness, may be fined up to RM 5,000 ($2,000) for noncompliance. The determination of guilt and fixing of the fine is by a special board of three members—one chosen by the accused, one by the executive committee, and the third by these two. Costs of the board are borne by the accused if proven guilty.

Pine seed from certain regions, East Prussia, for example, may be certified for use outside its own boundaries, while seed from the southwestern lowland pine forests must be used locally. Seed from two

different certified stands within a given region may be mixed together at the extractory or nursery, but must be kept separate from seed from other regions and uncertified seed.

Special rules are drawn up for certifying each species. These rules have undergone some change as more becomes known about the climatic races existing within each species. The rules for all species require that the certified forest stand or trees be straight-shafted, not inclined to branchiness when growing in closed stand, free from damage by men or animals, in good health and vigor, and in so far as ascertainable, of desirable heredity. The stand must be so located that cross-pollination with undesirable races is not likely to occur—for Scotch pine, at least 150 meters from stands of undesirable race. The stand must be of a certain minimum size and have reached a specified age, which varies for different species. No Scotch pine stands are eligible for certification that were planted during the period 1890-1910, when the importation of foreign seeds was at its peak. No stand can be certified unless it is under the direct supervision of a forester. Small owners may form an association which can then employ a forester to supervise their joint holdings. This renders all supervised holdings eligible for certification. The forester is charged with the responsibility of supervising the cone collection and sealing the containers.

The field inspection is made by a qualified officer of the central or regional committees together with his assistant or an associate who, in company with the local forester, visits every stand of eligible age in the ranger district which is to be certified. Any stand which appears at all questionable is examined in detail. The officers have with them maps and sheets on which each compartment is listed, with all pertinent details and remarks. Stands slow in growth, with branchy, ill-formed trees or with other objectionable features, are eliminated from the approved list unless it can be shown to the satisfaction of the inspecting officers that the poor form is due to the action of wind or because of poor soil conditions. In cases of doubt, the stand is eliminated. Naturally the officers must have ever uppermost in their minds how much the present condition of the stand is the reflection of soil conditions and silvicultural practice, and how much is the reflection of heredity (9). Wherever second generation trees from the older stand are available, they also are examined to determine their desirability for forest production. A forest or stand examined receives one of three ratings:

1. Certified as suitable for seed production.
2. Certified as unfit for seed production.
3. Certified as of indifferent or questionable value and to be avoided.

A stand falling in category 3 may sometimes be rendered eligible for certification at a later date after the objectionable trees have been removed in thinnings or preliminary cuttings. Stands certified as unfit for seed production are of such poor quality that silvicultural treatment cannot improve them sufficiently to place them in the eligible group. Since for most species the stands must be at least 50 years old before eligible for examination, the possibilities of further improvement through silviculture are limited.

The rating given is decided upon by the certifying officers, whose decision is ordinarily considered final. The examination of an average German forest of 3,000 to 5,000 acres will require about one day, or more if the transportation facilities are inadequate.

A forest may be certified only for four years. At the end of this period it must be reexamined. This gives an opportunity for improving the standards for certification in the future. A small fee, RM 50 ($20), is charged for examination, which helps to defray expenses.

The executive committees and regional

committees are made up of men who have been prominent in studying the question of seed origin and in advocating reform in the methods of handling seed. Inspecting officers are appointed by and trained by members of these committees. There is now under consideration means for careful review and check-up of the work of individual field inspectors by inspectors from the Central Office in Berlin. As stated in the law, the responsibility for certifying seed has been transferred from the Seed Certification Organization to the Federal Forester, who is modifying the organization and rules to make them more adaptable for universal application. The exact date has not been set when the provisions of Section 1, which require the elimination of all stands and individual trees of bad form, are to be consummated; but it is the goal of the Federal Forest Office to complete this task within 15 years. Thereafter the need for certifying individual stands should become less acute, and only certification by region should be necessary.

Germany has a Central Forest Seed Laboratory at Eberswalde which carries out an active research program on seed extracting, seed storage, and germination. In addition this laboratory has gone into the problem of physiological differences which seed of different racial origin may exhibit, and has investigated various laboratory methods of testing seed origin. The laboratory carries out a large part of the routine testing of genuineness, purity, and germination of forest seed, and in addition has developed new principles in kiln design and cleaning processes (23, 24).

Seed Control in Other European Countries

Brief summaries of the laws in force pertaining to both agricultural and forest seed in several countries have been published in the Proceedings of the International Seed Testing Association (36). A few of the more important attempts at origin control will be mentioned briefly.

Czechoslovakia.—Following a vigorous campaign by Vincent (27, 28) and Freudl (12), a law was passed requiring that all commercial forest seed must bear a label designating species, provenience, and nature of seed—i. e., whether cleaned or uncleaned. All imported seed of *Picea excelsa, Larix leptolepis, Abies pectinata,* and *Pinus silvestris* must be colored by addition of a dye when passing the customs. A system of voluntary certification, in which the seed extractors and nurserymen cooperate with a central forest seed control station, is in force. The country is divided into three main climatic regions. Seed collected in each region may be sown anywhere within the region, but not in other regions.

Rules for certification are formulated by the central laboratory, which also conducts routine tests of purity, germination, and origin (in so far as this can be determined in the laboratory) and issues certification labels to forest owners, seed extractories, seed dealers, and nurserymen.

The rules require (27): 1. A statement from the forest supervisor that he knows the stand or forest from which the cones were collected, and that its characteristics are truly described in the accompanying form. 2. Submittal to the seed control office of copies of all freight bills of lading of cones or seeds, and reports from extractories. 3. Actual laboratory test of sample. This includes comparison of the number of seeds per kilogram, the weight of one liter of seeds, and the morphological characteristics of seed and seedling with those of samples of known origin. While such comparisons cannot serve to identify seed origin with absolute accuracy, they do serve as an additional check on origin, and are very useful as supplementary methods in questionable cases. Here, as in Germany, only owners employing a forester can have their seed certified.

Sweden. — In Sweden attention was

called early to results of using German seed (32), and in 1882 the use of foreign seed for reforesting on government lands was prohibited. In 1888 a duty was placed on foreign seed, which has since been increased from time to time. Since 1910 imported spruce and pine seed is required to be dyed with eosin in the customs, in order to distinguish it permanently from native seed (25). In spite of these regulations, statistics on foreign trade showed almost as great a quantity of seed imported in the 5 years after 1919 (73,007 kg. or about 161,000 lbs.) as in the entire previous 32 years. Increased interest in forest planting and difficulty in obtaining seed during the war may have contributed to this. The Forest Conservation Boards used every effort to induce users of this imported seed to select origins having as nearly as possible similar climates to the planting sites. Most of the pine seed came from Finland, spruce from Germany. Furthermore, by the establishment of their own seed extraction plants in each county, the boards have striven to furnish woodland owners with nursery stock from seed collected in their own vicinity or in a temperature zone identical with their own. Many of these seed plants are very modern and equipped to handle large quantities of seed. They try to extract enough seed in crop years to cover the needs of their district until another crop year occurs.

Surplus stock, if of suitable zone, is sold to other county boards and to dealers, with origin carefully certified. Seed for sowing in state forests is collected in the ranger district where it is to be used, and after extraction returned to the district (21). In some cases different parts of the same district are kept separate if they differ sufficiently in temperature. Schotte's zones (25), based on isotherms for June-September, have been found too broad for safety in some sections. Eneroth (7) has shown quite conclusively that seeds sown on sites 1° C. colder than the point of origin give about one-third poorer results than at the point of origin. Cone lots should be kept separate for each 100 m. (328 feet) altitude. In 1905 Gunnar Andersson said the forest tree seed trade was like the clover seed trade 25 years before. In 1923 Dybeck could see no progress since 1905. In the last decade distinct progress has occurred. While the control of origin is considered far from satisfactory in Sweden, the educational work of the County Forest Boards is no doubt leading to increasing care and interest in the subject. All seed dealers in Sweden advertise the origin of their seed.

Norway.—In Norway until recent times planting has been done without the least attention to seed origin (2, 13). Great differences in altitude and climate and difficulty in obtaining seed locally have been factors. Forest seeds are now included under a general seed law. Imported seed must be sampled at the customs office, where Norway spruce and Scotch pine seed are dyed with eosin. Only about 5 years ago an arrangement was made whereby the Central Forest Experiment Station would furnish certified seed. A number of local extraction plants have been set up, mostly for getting seed for state forests (26). The problem is still far from solution.

Denmark. — Denmark, with small climatic differences, presents another problem. Most stands are artificial and established from imported seed. Proposals have been made to designate stands where collections should be made. As early as 1883 (31) steps were taken to insure that only Scandinavian seed was used on state forests. About 1925 a renewed effort was made toward establishment of a central seed clearing house, and stands suitable for collection were enumerated (18, 19). There is no compulsory seed control, but provisions are made for cooperative voluntary control of purity and germination by the Central Seed Laboratory. A distinct effort is made by seed dealers to furnish

seed of known origin, and with much of the seed sold a dealer's certificate of provenience is furnished. Danish forest supervisors are awake to the importance of seed origin, and have come to insist on seed of known origin for use in planting.

Switzerland.—Engler, following his experiments on origin of seed, recommended that the state take charge of the collection of forest seeds (8). In 1916 a state extraction plant was proposed to insure local collections (33), and government certification was made available to private plants. However, after guaranteed seed suitable for reforesting at high elevations was placed on the market, demand for it was poor (15). The majority of forests have good natural reproduction, so that very little artificial planting or seeding is required. Most cones are extracted in the government plant, where the various lots are kept carefully separated.

Italy.—Under the present regime very strict regulations are in force for keeping record of seed origin.

Austria. — Some of the earlier experiments on seed origin were initiated in Austria by Cieslar between 1897 and 1900. A recent seed law requires that commercial seed of the important forest species must be packed in closed containers bearing obligatory declarations stating species, amount of seed, year of harvest, purity, germination, place of extraction, and origin, including, if possible, altitude and a description of the soil characteristics. The experiment station and seed laboratory furnish certificates of germination and purity. Changes in the seed law are being considered.

Belgium. — Proposals have been made (22) that the state operate extraction plants. The forest experiment station is actively interested in the provenience question.

Holland.—First attempts were made in 1911 to control the origin of Scotch pine seed, most of which was imported, but these failed, due to lack of cooperation from nurserymen. In 1923 further agitation was made by the Society for Planting Waste Lands (Nederlandsche Maatschappi), and in 1924 an association of nurserymen and seed extraction plants was founded, whose members voluntarily agreed to certify the origin of Dutch-grown seeds. A bond is posted on joining the association, which is forfeited should the member wilfully or inadvertently break his agreement. Representatives of the State Forest Experiment Station and Reforesting Society are among the officers of the Society. Seeds may be gathered from any tree or stand. Dutch origin only is certified, and importation is allowed only when local seeds cannot be obtained.

While this arrangement has many advantages, it is open to the objection that collection of seed from plantations in Holland may lead to perpetuating a poor race, since most of the older plantations were made with imported seed. Importing seed of a race known to thrive in Holland might be preferable.

Progress Toward International Certification of Provenience

Many proposals have been made for an international board of some kind which would integrate some of the activities of the various countries, designate collection zones, and certify sources. This was discussed about 1906, when the International Union of Forest Experiment Stations distributed seed samples for testing different proveniences. It was in the agenda of the World Forestry Congress at Rome in 1926. At the Stockholm meeting of the Union in 1929 the senior author attended the meetings of the sub-committee of the second section, dealing with seed provenience. A motion was passed urging the various stations to separate seed collections by latitude, altitude, and other climatic factors (35, 14). Konsel (16) also proposed a reorganization of international seed trade

to insure separation of origin. At the 1932 Congress at Nancy, Vincent (29) outlined a procedure for international certification patterned after that in effect in Czechoslovakia. Briefly, he proposed a division of each country into Rubner's climatic zones, and voluntary submittal of seed to the forest experiment station for certification. A firm wishing certification would apply to its local experiment station at the beginning of collection, filling out an appropriate application, and at the end of collection describing in some detail the stands from which collection was made, amounts, etc.

If collection was not done under the supervision of a local forest supervisor who could certify to the origin, it would be the duty of a forest inspector to visit the scene from time to time. It is evident that systems of this sort would work out best in countries having a highly organized system of district foresters and rangers.

The Seed Supply Situation in America

Canada.—In Canada, records of seed origin of plantations were kept for several years by the Laurentide Company, Ltd. The Dominion and many of the Provincial forestry departments and seed plants have been careful to keep different origins separate. At Berthierville, P. Q., for instance, cones collected in a certain county are kept separate during extraction, and seed and transplant beds are carefully labeled with the name of the place of collection. Planting stock is sent out only to the locality where the seed was collected. Most seed houses furnish data on origin of their seed. The Dominion Forest Service maintains a modern extractory at Angus, Ont., where efforts are made to assure separation of origins.

United States. — In the United States marked progress in labeling seed with the place of origin can be noted in the past decade. This has been done by dealers in response to a foreign demand for more complete information, and to requests from well-informed foresters in this country. Some seed dealers, both in the East and in the West, have been supplying quite complete data with their seed for nearly 10 years. These include altitude, mean annual rainfall, mean summer temperature, general locality of collection, and in some cases type of soil, etc. Recently a weakening of enthusiasm can be noted, and the data are not as complete as formerly. Many other dealers furnish some information on origin. This is largely taken from foreign seed sources whence their seed comes. In fact, providing the data supplied are reliable, it is usually adequate for an intelligent selection of seed. At the present time, deficiencies in origin records are due more to nurserymen and planters than to failure of seed dealers to supply information.

In regard to imported seeds, Regulations 3 and 7 of Quarantine 37 (Amendment No. 2, effective January 14, 1935) provide a basis for requiring origin data. Regulation 3 provides that "seeds may be imported without limitation as to quantity or use from countries which maintain inspection, under permit." Regulation 7(b) specifies: "Each package shall show nature and quantity of contents, the district or locality and country where grown, name and address of exporter."

If this latter requirement of "locality and country where grown" were enforced and its validity could be relied upon, it would provide a reasonably satisfactory basis upon which to purchase seed from natural stands in foreign countries. About 150,000 pounds of tree seeds are imported annually. Much of this seed is used for decorative stock, but the quantities of seed of native forest species such as white pine and black locust are still large.

In brief summary, no official state or government certification of origin is at present required in the United States or is available for tree seeds. The Seed Veri-

fication Service in the U. S. Department of Agriculture certifies origin of field crop seeds, but it is doubtful if it could handle the immensely complex problem of tree seed. Seed dealers have shown a growing tendency and willingness to tell the purchaser where their seed was grown. Import regulations require this of imported seed. If origin data are reliable, the chief difficulty remains the carrying of origin records through to the plantation.

Experience of countries where certification has been tried, including that in the United States covering agricultural seed, indicates that some form of voluntary agreement among collectors, dealers, and a government seed control laboratory is preferable to obligatory state control.

Discussion of a forest seed program for the United States is reserved for a later paper.

Literature Cited

1. Baldwin, H. I. 1933. The importance of origin of forest seeds. Empire For. Jour. 12: 198-210.
2. Barth, A. 1904. Den ukontrollerede kongleinsamling en fare for vore fremtidige kulturskoge. Forstligt Tidsskrift 3: 100-103.
3. Bates, C. G. 1927. A vision of the future Nebraska forest. Jour. For. 25: 1031-1040.
4. Burger, H. 1931. Einfluss der Herkunft des Samens auf die Eigenschaften forstlichen Holzgewächse. Mitt. d. schweiz. Centralans. f. d. forst. Versuchswesen. 16: 153-230.
5. Champion, H. G. 1933. The importance of the origin of seed used in forestry. Indian For. Rec. 17 (Part 5): 1-76. Calcutta.
6. Cieslar, A. 1907. Die Bedeutung klimatischer Varietäten unserer Holzarten für die Waldbau. Centralbl. f. d. ges. Forstw. 33: 1-19; 49-62.
7. Eneroth, O. 1926. Studier över risken vid användning av tallfrö av för orten främmande proveniens. Medd. f. Statens Skogsförsöksanstalt 23: 1-62.
8. Engler, A. 1905. Einfluss der Provenienz des Samens auf die Eigenschaften der forstlichen Holzgewächse. Mitt. d. schweizerischen Centralanst. f. d. forstl. Versuchsw. 8: 1-156.
9. ———. 1924. Heliotropismus und Geotropismus der Bäume und deren waldbauliche Bedeutung. Ibid 13: 225-283.
10. Enquist, F. 1929. Studier över samtidiga växlingar i klimat och växtlighet. Svensk Geografisk Arsbok.
11. ———. 1933. Trädgränsundersökningar Sv. Skogsvårdsför. Tidsk. 31: 145-214.
12. Freudl, A. 1929. Beitrag zur definitiven Lösung der Frage der Beschaffung von Forstsämereien. Lesnicka prace 8: 104-115.
13. Giertsen, B. R. 1904. Vort skogfrø. Forstligt Tidsskrift 3: 75-78.
14. Guinier, Ph. 1930. L'Organisation internationale de la récolte des semences forestières avec garantie d'origine. Proc. Int. Cong. For. Exp. Sta. Stockholm, 1929. 37-39.
15. Knuchel, H. 1929. Garantierter Hochgebirgssamen. Schweiz. forstl. Zeit. 80: 142-143.
16. Konsel, J. 1930. Evidence and control of forest seed for international trade. Proc. Int. Cong. For. Exp. Sta. Stockholm, 1929. 315-317.
17. Langlet, O. 1934. Om variationen hos tallen (*Pinus silvestris* L.) och dess samband med klimatet. Sv. Skogsvårdsför. Tidsk. 32: 87-100.
18. Larsen, C. S. and A. H. Grøn. 1925. Er der Muligheden for og Grund til at etablere en rational dansk Skovfrøavl. Fra Skoven og Traemarkedet 7: 207-215.
19. Nielsen, C. 1925. Bedre Udnyttelse af Frø af gode hjemlige Racer. Ibid 7: 18-20.

20. Oppermann, A. 1909. Renkbuchen i Dänemark. Centralbl. f. d. ges. Forstw. 35: 108.
21. Romell, L. G. 1926. Sveriges skogsfröförsörjning. Skogen 13: 115-132.
22. Rosséels, E. 1929. A propos de la selection des essences forestières. Bull. de la Soc. Cent. For. de Belgique. 36: 291-298.
23. Schmidt, W. 1930. Unsere Kenntnis vom Forstsaatgut. Berlin.
24. Schmidt, W. and W. Hildebrandt. 1930. Rationelle Forstsaatgutreinigung. Zeit. f. forst. u. Jagdw. 62: 1-18; 94-114.
25. Schotte, G. 1910. Om färgning af skogsfrö i syfte att utmärka utländsk vara. Medd. f. Statens Skogsförsöksanstalt. 7: 69-90.
26. Smitt, A. 1929. Provieniensspørsmålet. Tidskr. for Skogbruk. 37: 143-162; 275-286; 455-463.
27. Vincent, G. 1927. Evidence lesnich semena sazenic C. S. R. Cal. Matice lesnicka Cechy.
28. ————. 1930. Evidenzführung der forstlichen Samen und Pflanzen nach ihrer Herkunft. Proc. Int. Cong. For. Exp. Sta. Stockholm, 1929: 343-347.
29. ————. 1933. Wie liesse sich die internationale Evidenz der Samenherkunft durchführen? Compt. Rend. Cong. de Nancy, 1932: 238-254.
30. Wibeck, E. 1926. Proveniensfrågaens nuvarande ställning i Tyskland. Sv. Skogsvårdsför Tidsk. 2: 381-408.
31. Anonymous. 1883. ("Tzsch.") Om det svenska furufröet. Tidskr. f. Skogshushållning. 11: 31-36.
32. ————. 1883. ("N. A.") Skogsvännen. 8: 44.
33. ————. 1916. Bestrebungen zur Beschaffung guten Waldsamens von geeigneter Provenienz. Centralbl. f. d. ges. Forstw. 42: 301-303.
34. ————. 1926. Merkheft zur forstlichen Saatgutanerkennung. Hauptausschuss für forstliche Saatgutanerkennung. Zweite Auflage. 1-24. Neudamn.
35. ————. 1930. Proc. Int. Cong. For. Exp. Sta. Stockholm, 1929: 714.
36. ————. 1930-32. Summaries of laws and regulations on seed in force in various countries. Proc. Int. Seed Testing Assoc. Nos. 13 and 14 (1930) pp. 49-89; 15 and 17 (1931) 144-174; 1 and 2 (1932) 65-66, 188-194.
37. ————. 1933. Jahrbuch des Hauptausschusses für forstliche Saatgutanerkennung für 1933. Potsdam.
38. ————. 1934. Anerkennungsregeln des Hauptausschusses für forstliche Saatgutanerkennung. Potsdam, 1-12.
39. ————. 1934. Das forstliche Artgesetz. (Dec. 13) Reichsgesetzblatt 134: 1236-1237.

THE C.C.C. AS AN AGENCY FOR STAND IMPROVEMENT

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IN view of the great good which has been accomplished in many forest regions by the C.C.C., it seems very unfortunate that so much criticism should be leveled at it by foresters. The general public has accepted it chiefly because of its social benefits. Why should foresters, who are the chief beneficiaries, throw mud at it? Perhaps this is because the Administration has been slow to adopt the many constructive suggestions which have been made by groups of foresters closely connected with the work. Besides the increasing insistence upon appointing politically sponsored men to supervisory positions, there are several other factors which have resulted in inefficiency or extravagance.

Factors which have made for inefficiency have been the shortness of the working hours; the fact that camps have never been kept up to authorized strength; the large overhead used by the Army, often without adequate supervision; the lowered age limit for enrollees, which has brought into the camps a lot of boys of underweight and understrength; and the impossibility of keeping first-class men indefinitely. If the C.C.C. is to fulfill its greatest usefulness both from a social and a forestry standpoint, provision should be made for a certain percentage of the best men to remain in the camps and advance through the rank of squad foreman to that of foreman and to permanent employment in the forests.

Several factors have made for extravagance. Enrollees were paid too much in view of the high overhead of operating the camps. There are too many high-salaried officials, Army and technical combined, connected with a camp. Much money was wasted in enlarging the C.C.C. and building new camps to be used only for a brief period. The educational set-up has cost more than the results warranted. Most of the real instruction is still given by the foremen. The Forest Service has used "thumb tack" economy in carefully checking up on the use of small items while wasting large amounts in the purchase of heavy equipment poorly adapted for the work in hand. Supplying eastern camps with Springfield envelopes through the Oakland, Calif., office is an example of inefficiency.

In spite of these and other weaknesses, the C.C.C. is a wonderful agency if properly used. Some foresters not connected with the organization have been inclined to criticise the relatively small amount of stand improvement accomplished. However, a good road system is fundamental to the practice of forestry. Wherever forests have been developed with truck trails this work should be considered fully as important as stand improvement. If there are any states which have not done a large amount of truck trail construction and stand improvement, it is their own fault and not that of the C.C.C., for the facilities have certainly been available. Since my own experience with the C.C.C. has been mostly in Connecticut, this article will deal with our work here. Table 1 shows the distribution of labor by major projects from the time the first Connecticut camps were established up to January 31, 1936.

This table shows that one-third of all labor has been expended in truck trail construction, which in our region is im-

TABLE 1

DISTRIBUTION OF MAN-DAYS IN CONNECTICUT C.C.C. CAMPS, BY PROJECTS

Project	Number of man-days	Per cent
Truck and foot trails	480,630	33.1
Forest stand improvement	304,089	21.0
Insect and disease control	240,223	16.6
Fire prevention and control	122,482	8.4
Recreational developments	119,457	8.2
Maintenance[1]	90,444	6.2
Surveys and type maps	68,844	4.7
Administrative structures	20,153	1.4
Miscellaneous	4,436	.3
	1,450,758	100.

[1]This includes maintenance of truck trails, structures, picnic areas, fire towers, insect work, etc.

portant not only from the standpoint of protection and utilization but also because of the ever-increasing recreational use of our forests. In deference to the agitation for wilderness areas, one of our wildest and most picturesque blocks of 1,800 acres has been left entirely undeveloped with truck trails. Since the state forests of 66,000 acres amount to only 4 per cent of the wooded area of the state, it is felt that there is plenty of undeveloped private forest and that the function of the State Forestry Department is to demonstrate intensive forestry practice on the greater part of the state forests. Any state forests acquired after the termination of the C.C.C. will be developed very slowly by comparison. Up to date 105 miles of truck trail have been completed. Omitting the wilderness area mentioned above, this is an average of one mile of road to every 611 acres.

Owing to the irregular topography there are still many inaccessible compartments where forest products cannot be removed, and where stand improvement is therefore limited to the weeding and releasing of young stands. Up to the present time only one-quarter of the entire area, or 15,450 acres, has been improved, through the expenditure of 304,000 man-days of work. This is an average of 20 man-days per acre for all work The distribution of this labor is shown in Table 2.

Nursery.—Comparatively little work has been done in the nurseries with C.C.C., as the state appropriation has been nearly sufficient. Men in four camps have been used for brief periods.

Sample Plots.—Two kinds of plots have been established, under a well trained silviculturist. About 75 three-tenth acre plots were established in plantations made by the C.C.C. to determine survival. At

TABLE 2

DISTRIBUTION OF MAN-DAYS CHARGED TO STAND IMPROVEMENT

Subproject	Number of man-days	Percentage of man-days	Acres treated	Average number of man-days per acre
Nursery	280	.1	—	—
Experimental plots	5,525	1.8	—	—
Transportation and manufacture of posts, lumber, shingles	8,281	2.7	—	—
Planting	25,871	8.5	1,638	15.8
Plantations:				
a. weeded	14,566	4.8	3,433	4.2
b. thinned	5,924	1.9	170	34.8
Natural stands:				
a. weeded	9,554	3.1	2,295	4.1
b. reproduction cutting	1,861	.6	54	34.5
c. sanitation cutting	4,222	1.4	420	10.
d. improvement cutting	202,393	66.7	6,938	29.2
e. clean-up	25,612	8.4	500	51.2
	304,089	100.	15,448	20

the end of the first growing season these plots of 10 species showed a survival varying from 95 per cent for white pine, Douglas fir, and Colorado blue spruce to 80 per cent for Scotch pine. Hemlock plots showed only 65 per cent survival. These figures compare most favorably with survival in plantations made by regular labor. Similar plots showed a 50 per cent survival of oak seedlings one year after planting acorns. Another series of plots shows that 18 per cent of Connecticut sprout hardwoods are subject to stump rot.

Manufacture of Products.—The state maintains a sawmill and a small shingle mill where lumber and shingles are made for the building program of the C.C.C. The shingles are made of southern white cedar. It is estimated that a cord makes about 2,500 shingles, worth $27.50, and that it costs about $17.50 to manufacture them, so that the profit per cord is $10 as compared to $8.75 for lumber. The sawmill has utilized 527 man-days and the shingle mill 311.

One of the outstanding accomplishments of the Connecticut C.C.C. has been converting the State Highway Department away from concrete to creosoted hardwood fence posts. Preliminary experiments had convinced the Department that hardwoods were practicable, but it would not incorporate these in their specifications unless assured of a definite supply. The C.C.C. set up a small creosoting plant and cut and treated 27,050 posts of oak, soft maple, birch, and beech. This project utilized 5,196 man-days in creosoting, and 2,247 man-days in transporting the posts to the plant. Now that it has proved a success, the plant has been leased to a fence contractor and Connecticut farmers are assured a market for their thinnings which they would not have had except for this initial work of the C.C.C.

Planting.—An average of 15.8 man-days per acre for planting is due to the fact that the Forest Service requires that "preparation of land for planting" should be charged under this heading instead of to "reproduction cutting," where it properly belongs. As most of the open land in the Connecticut state forests has already been planted, the C.C.C. men have been employed in cutting off stands of gray birch, alder, and other worthless growth and planting it. Since the brush is piled and burned, the preparation requires about 22 man-days per acre while the actual planting requires about 4 man-days.

Weeding and Thinning Plantations.—Weeding requires only 4 man-days per acre, as it is simply cutting hardwood brush with machetes. A small area of badly neglected older plantation was thinned with an average of 35 man-days per acre. Part of this expense was due to peeling soft maple posts cut out in the thinning.

Treatment of Natural Stands.—The weeding in young hardwoods requires 4 man-days per acre, just as in plantations. The purpose is to free enough hardwoods of valuable species to make a stand.

Reproduction cuttings are expensive in labor because the brush in most cases is burned. Clean-up work along roads for fire protection is also labor-consuming because all dead trees are removed and the underbrush is cut and burned on a strip next to the roads.

Sanitation cuttings, which consists of the girdling or felling of diseased hardwoods, consumed 10 man-days per acre.

Improvement Cuttings.—It will be noted that two-thirds of all labor charged to stand improvement was for "improvement cuttings," i. e., cuttings in natural stands made for the purpose of securing a stand of valuable species. Much of this work was formerly called "thinning," but that term is now used to designate an operation made in an older stand for the purpose of increasing the

growth. Improvement cuttings are made with axe and saw, usually in stands between 20 and 50 years old, and result in products varying from 1 to 6 cords per acre or the equivalent in logs and posts. All stands in which improvement cuttings are to be made are marked by a technical forester. The crop trees which are to be left to the end of the rotation are selected first. Then the trees which are interfering with the proper development of the crop trees are marked for removal. It is a crown thinning in which trainers are left as well as crop trees. The average time required for such cuttings is 29 man-days per acre.

The wood is piled where cut and then yarded on roads where it can be loaded onto trucks. Most of this yarding has been by team, but for a time no money was available for team hire and considerable wood was carried out by man power. This is one factor in the labor item. In some camps considerable wood has been yarded by tractor and sleds. In one camp a hand sled has been used, but even with this it requires about one man-day per cord to yard.

When the wood is repiled at road, it is graded into two classes. All high-grade hardwood is sold on the roads at prices varying from $3 to $4 a cord. All dead and fire-scarred wood, or wood from poor species such as poplar, gray birch, or softwoods, is piled as second-quality wood and is available to the Army for use in the camps. Some not required by the Army is sold or given to the towns for distribution to the poor. Until July 1, 1935, the Technical Agency paid for yarding Army as well as salable wood and expended $32,251.69 for team hire, an average of $1,344 per month. Under orders from the Forest Service this practice was discontinued at that time, and since then the amount spent for team hire to January 31, 1936, has been $3,326.03, or an average of $475 per month. Most of the Army wood has been hauled into the camps in forestry trucks, and this labor was also charged against the project until October 1, 1935. Since that date this labor has been carried by the Army.

Table No. 3 shows the products made by the Connecticut C.C.C. camps during the first two and one-half years, and the disposal of the same. About half of the cordwood cut was consumed in the camps themselves. Since we have had 44 camp-winters, the average amount of wood used per camp per winter has been 475 cords.

In order to ascertain the reason for the large number of man-days on stand

TABLE 3

FOREST PRODUCTS MADE BY CONNECTICUT C.C.C. FROM JULY 1, 1933, TO JANUARY 31, 1936

Amount produced			Amount sold	
Number	Product	Value in woods	Number	Receipts
40,473[1]	Cords of wood	$81,346	7,057	$24,617.59
124,583	Fence posts	21,070	52,020	15,228.21
847,800	Board feet of logs	7,206	48,700	562.12
37,098	Tobacco poles	4,957	21,873	3,097.42
	Miscellaneous	1,820		465.51
		$116,399		$43,970.85

[1]Disposal of the wood cut was as follows:

	Cords
Given to the Army for camps	20,862
Sold	7,057
Given to communities for the poor	730
On hand January 31, 1936	11,824
	40,473

improvement, a careful analysis of labor was made during the three months of December, 1935, and January and February, 1936. The results are indicated in Tables 4 and 5.

It will be noted that the average number of man-days per acre for this three months' period is 17.4, as compared to 20 for the previous two and one-half years. This is due in part to the fact that more of the work has been weeding in young stands, which requires only 4.3 man-days per acre, about the same as previously. If the figure for preparation for planting, 30.6 man-days, is compared with the former figure for reproduction cutting, 34.5, a slight improvement is evident. However, the real gain is in the improvement cuttings, where the figure has been reduced from 29.2 to 16.4 man-days. This improvement is due partly to the fact that less wood has been carried out to the roads by man-power because teams were available, and because men used in transporting wood to the camps are now charged to the Army. It is also due to improved practices; the use of better kept saws and axes; more care in the selection of trees for cutting by leaving suppressed trees; and leaving on the ground small and decayed sticks which were formerly taken to camp. In other words, we have got the men away from the park idea of cleaning up everything.

No attempt was made to distribute the overhead against the various operations, but the table shows that 2.2 man-days, or 11.2 per cent of the time on all operations is chargeable to overhead. This labor, which does not include the time of foremen, represents items which would not be included in a commercial operation, but is necessary in the E.C.W. set-up. It includes such men as the tool clerk, the blacksmiths' assistant, and the truck drivers who heat the lunches for the men. The remaining 15.2 man-days of 6 hours of work are equivalent to 11.4 man-days of 8 hours.

It will be noticed that in preparing land for planting somewhat more than half the time is required to pile and burn brush; and that the actual time in chop-

TABLE 4

ANALYSIS OF COST PER ACRE IN MAN-DAYS OF STAND IMPROVEMENT, CONNECTICUT C.C.C. CAMPS—THREE MONTHS

Operation	Acres treated	Chopping and sawing— Total Man-days	Chopping and sawing— Man-days per acre	Brush disposal— Total man-days	Brush disposal— Man-days per acre	Total man-days per acre
Improvement cutting	1,277	20,083	15.8	1,139	.6	16.4
Weeding young stands	603	1,900	4.3			4.3
Preparation for planting	334	5,133	15.	5,454	15.6	30.6
Total—all operations	2,214	27,116	12.2	6,593	3.	15.2
Overhead man-days		3,956	1.8	961	.4	2.2
Total, including overhead		31,072	14.0	7,554	3.4	17.4

TABLE 5

ANALYSIS OF COST PER CORD IN C.C.C. MAN-DAYS OF STAND IMPROVEMENT—THREE MONTHS

Operation	Cords produced	Cords per acre	Chopping and sawing, man-days per cord	Brush disposal, man-days per cord	Removal of products, man-days per cord	Total
Improvement cutting	5,411.5	4.2	3.7	.2	1.	4.9
Weeding young stands	206.7	.3	6.4			6.4
Preparation for planting	1,347.	4.0	3.8	3.9	.5	8.2
Total	7,065.2	3.2	3.8	.9	.9	5.6
Overhead, man-days			.6	.1	.2	.9
Total, including overhead			4.4	1.0	1.1	6.5

ping and sawing is about the same as in improvement cuttings.

The removal of products to the road required an additional 5,580 man-days, or an average of 2.5 per acre. This included 738 man-days brushing out 14.4 miles of wood road at an average of 51.2 man-days per mile. While no provision is made for such work in the E.C.W. set-up, it is much more economical, as every lumberman knows, than yarding without roads. Except in a cedar swamp, the time required for such road brushing did not exceed 36 man-days per mile.

Table 5 presents an analysis of the labor per cord on the same operations.

This shows that it requires an average of 4.4 man-days per cord to chop and saw wood; 1 man-day per cord to dispose of the brush, and 1.1 man-day for removal; or a total of 6.5 man-days per cord. Of this labor about 14 per cent is overhead; 70 per cent is actual production, and the remaining 16 per cent is divided equally between brush disposal and removal of products. The 4.4 man-days spent on actual production is equivalent to 3.3 8-hour days. Upon this basis, the average C.C.C. worker is about one-third as productive as a good chopper, or one-half as productive as the average chopper available for work in Connecticut today. Of course, any old-time woodsman will produce from 4 to 6 times as much. However, when we consider that most of these boys are from industrial cities and never handled an axe previous to a few months ago, the record is not too bad. At the time of C.W.A., winter of 1933-34, some tests were made of the relative efficiency of C.C.C. and C.W.A. men. The latter averaged 40 years of age. They were not necessarily relief cases, and therefore were more productive than the later W.P.A. men. The C.W.A. men put up an average of three-quarters of a cord in a 6½ hour day, which was slightly more than C.C.C. men made in parallel tests.

The above figure of 1.1 man-day per cord for removal to the road is an average for several methods used. In order to get a basis for comparing the cost of the various methods of removal, Table 6 is based upon the assumption that C.C.C. labor costs $2.50 per day.

It will be seen that team hire is much the cheapest method, even when C.C.C. labor is figured as low as $2.50 per day.

Under the agreement made between Governor Cross and Director Fechner when the C.C.C. was established in Connecticut, the state has reimbursed the federal Treasury $22,652 on the receipts up to March 31, 1936. We understand that this is the largest reimbursement made by any state.

Of course there are various reasons why some of the other states have not done much in stand improvement. Many states either do not have state forests or the forests are so poor that they offer little opportunity for work other than planting. In New York the Conservation Department is forbidden by the Constitution to make cuttings in the State Preserves. In Massachusetts the interests of the Conservation Commissioner were wholly in recreational developments. Probably the success or failure of the C.C.C. in stand improvement work depends largely upon the selection of the supervisory personnel. In states having a large proportion of politically appointed foremen it is probably better that little stand improvement has been undertaken. In Connecticut, with 17 camps,

TABLE 6

COMPARATIVE COST OF REMOVING FOREST PRODUCTS BY HAND, TRACTOR, AND TEAM. C.C.C. LABOR AT $2.50 PER DAY

Method	C.C.C. man-days per cord	Cost of C.C.C. labor per cord
Hand	2.8	$7.00
Tractor	1.4	3.50[1]
Team	.2	0.50[1]

[1]This does not include cost of fuel and depreciation of tractor, or the hire of team and driver. The latter averages $1.25 per cord.

the personnel is as follows:

Superintendents (all nonpolitical)	17
Technicians, clerical staff, and draftsman	12
Blacksmiths, mechanics, and machine operators	33
Junior foresters	15
Political appointees	14
Other technical foremen	47
Other nontechnical foremen	70
Squad foremen	19
	227

It will be seen from the above list that only 6 per cent of the supervisory personnel are from political lists. These men have been carefully selected and average perhaps as efficient as the other nontechnical foremen. It is easy to understand, however, that these men are much more ambitious to keep up to the high standards set by a large majority of the foremen than they would be in establishing an efficient organization were politics to dominate the situation. The widespread commendation of the C.C.C. in Connecticut, especially in recognition of the splendid work done after the recent flood disaster, indicates that the public and the political leaders appreciate the organization as at present constituted.

CONTROLLED BURNING IN LONGLEAF PINE SECOND-GROWTH TIMBER

By N. G. T. SIMERLY

The following narrative recounts the personal experience and observations of a veteran practical woodsman, in the matter of fire control on a 50,000-acre tract of second-growth longleaf pine in Baldwin County, Ala. An introductory note by Prof. H. H. Chapman provides orientation.

[This article sets forth Mr. Simerly's conversion to the principle of controlled burning, and the methods by which he has achieved an outstanding success in its application. The changed conditions and increasing hazards brought about by fire exclusion, the loss of forage, the increased hostility of cattlemen, and the tendency on the part of settlers to fire the woods during the summer season instead of, as formerly, in the winter season, are presented as convincing reasons for adopting controlled burning on the Baldwin County tract. This tract not only constitutes what is probably the finest stand of this species of recent origin, but was until recently perhaps the most outstanding example of successful exclusion of fire from pole timber within the range of the species.

Baldwin County, Ala., has a large body of the Norfolk soil series, which has proved to be an exceptionally favorable site for longleaf. The seedlings develop more rapidly than on other soil series, even in the same vicinity. This early vigor tends to carry them past the initial stage of root and bud development to the point where energetic height growth begins, with a minimum danger of stagnation. The large areas of pole stands of longleaf on the particular tract with which the following account deals were almost exclusively on the Norfolk soil series.

Since these stands were from 30 to 40 years old when the tract was acquired, it is evident that they originated in a period when no fire control had even been thought of. These seedlings manifestly survived fires which may have been of annual occurrence, or may have burned not oftener than once in two years. It is hardly possible that they escaped fire for longer periods, for until the purchasing company undertook the exclusion of fire, under Mr. Simerly's supervision, no organized efforts had been made to prevent the habitual burning of the longleaf pine forests by stockmen.—*H. H. C.*]

IN the year 1917 I was asked by the Tennessee Coal, Iron, and Railroad Company, a subsidiary of the United States Steel Corporation, to assemble about 50,000 acres of forest land for them. After studying lands available over a large territory, I decided that Baldwin County, Ala., offered the most advantages. I bought 50,000 acres there; and to get a better rate of growth I decided to practice 100 per cent fire protection, as far as lay in my power.

This is a longleaf territory, and one of the few where it is possible to get a come-back stand of almost 100 per cent longleaf pine without the use of fire to kill out the loblolly and other species of pine or hardwoods which spring up in most territories where fire is not used. The one exception to this statement is along the branches, where some very fine slash pine has grown up or where some of the original virgin slash pine still remains.

The first year or two I met with very little success in my protection work. The cattlemen insisted on burning. Gradually I was able to show them that their cattle were not hurt by protection, for although there was less grass in the spring of the year, there was more forage for the cattle during the winter when the forage was most needed. In Baldwin County they have the open range, and a large percentage of the cattle must shift for themselves through the year.

After about 13 years, because of the age limit I was retired by the Steel Corporation. In spite of my age I felt that I was still capable of carrying on my work, and I found employment with Mr. Ben May, who owned about 40,000 acres of land in Baldwin County. Mr. May had been practicing protection for some time, and had spent considerable money not merely for fire lines but also for fire towers and for automobiles equipped to carry water and other means of fighting fires.

About three years ago I began to change some of my ideas as to the value of protection. I found that, first of all, opposition from the cattlemen, which for a time had been getting weaker and weaker, was inclined to grow strong again. Where the timber had been protected too long, there was so much straw on the ground that the cattle could not reach what grass was left. Also, the straw and the shade were killing out the grasses. Further, the local people were learning more and more how to set out fires difficult to fight because strung over a large area, or started on a dry, windy day.

I also learned that, despite the idea held by many people that there was no danger of a fire covering a large area if one was determined to fight and extinguish it, on one of the government forests near Lake City, Fla., and also at Cogdell, Ga., there had been single fires which covered more than 10,000 acres, and that these fires could occur at a time of the year when the damage was tremendous. Further, I heard that at Urania, La., there had been a July fire which covered only about 80 acres of longleaf pine, which was then about twenty years old, but that the result was the loss of all of the pine of this age. Practically no seed trees were able to survive this fire.

I decided that human nature was not going to change over night, and that there would be certain of the meaner type of man who would continue to burn the woods. I figured further that the longer protection was practiced the more these people would learn of the damage which was caused by summer fires, and I felt that it was quite possible for fires to come along at the wrong time and ruin entire forests. One can work thirty years or forty years to build up a forest, and if a fire comes on a dry windy day in July, it can ruin all the long work in a day or two.

With all these considerations in mind, I suggested to Mr. May that he allow me to practise controlled burning on some of his land, and then if the result pleased him and me, that I be allowed to practice controlled burning on all his Baldwin County lands.

I did my first burning at night or late in the afternoon. Before beginning any burnings I had made notations for some time previously and had kept a sort of diary of the weather. I studied particularly the duration of the wind from the different directions, and it was the study of these winds which helped me to decide the proper evenings on which to start my burnings. I always fired against the wind, and of course I wanted to be as near certain as possible that the wind would not prove a variable wind and turn out to be my "enemy" rather than my "friend" for the job in hand. By choosing the proper time, I was able to burn over 5,000 acres of land, and, to my surprise, I found that even in thick stands

of slash pine where the slash was not over two feet high, the mortality was not even 10 per cent. This included burning on land where no fire had taken place for more than 8 years. I found that I was able to burn the land in such a way that most of the longleaf pine did not even have the needles singed, nor was the bark of the tree near the ground even blackened. You could not tell that burning had taken place except by looking at the ground and seeing that the litter had been consumed.

Government men who were making studies on controlled burning have looked at my work this past winter, and said it is the finest example of proper burning that they have ever seen. I do not attribute this to any particular brain power which I possess, but rather attribute it to the studies that I made of the terrain, and to the studies of the weather before I began to burn.

During the following summer I noticed no apparent damage to the timber on this particular 5,000 acres. This past winter I have reburned that 5,000 acres, and also all of the lands which I look after in Baldwin County. This is about 40,000 acres in all. No timber has been killed except a very little of the young slash pine. The only needles which have been singed were where the land dipped into open space, causing a draft which would make the blaze flare up a little and thus rise high enough to brown the needles on entering the trees. But the flame only rose to a moderate height, and only the lower branches showed any brown needles where the land dipped. By "dipped" I mean where the land was level but suddenly would drop down a moderate hill or hillock.

I do not feel it wise to make a definite statement as to the wisdom of controlled burning every year until I have tried this method out for at least 5 more years; but I believe the advantages of controlled burning are not merely those which have formerly been pointed out by Professor Chapman, of Yale; another advantage is that you insure your forest against sudden loss from one very destructive fire. Furthermore, the growth will not be slowed down enough to offset the money which will be saved by controlled burning in place of total protection.

On this land, which had not been burned for from 5 to 10 years, I burned fire lines and broke up the land just as previously. This was because I did not want to take any chance of a fire getting out of control. Next year I expect to need fewer fire lines, for the litter on the ground will be much lighter and it should be easy to control a fire if the wind should change on me.

At present numerous large owners are attempting total protection, but I have noticed lately that they are losing large areas in spite of the fact that, besides having their own employees on the job, the government and state through the C.C.C. camps are giving better cooperation to those who wish to protect than I have ever seen previously. If I could be certain that the C.C.C. would exist indefinitely, and that the government would for an indefinite time permit private land owners to have one man for each 2,000 acres, I might feel it safe to risk protection. Even then, I am not certain that 25 men or 100 men can stop a bad fire if the wind is behind it. The main point in stopping such a fire is not the number of men, but rather one superior brain which can judge how far back it is necessary to go in order to back-fire. The wind and the drafts are so severe with one of these big fires that embers can be carried a half-mile, and new fires are thus set.

THE PLACE OF FORESTRY IN THE NEW AGRICULTURAL CONSERVATION PROGRAM[1]

By EDWARD BEHRE

Northeastern Forest Experiment Station

The new Agricultural Conservation Program, replacing the invalidated A.A.A., may provide a major stimulant to farm forestry. This is of especial significance in the Northeast, where farm woodlands constitute such an important element in rural economy. Planting of forest trees has already been recognized as a basis for federal aid under the new act. Fencing of woodland against grazing and silvicultural measures for forest improvement have been recommended for payments by some of the Northeastern states. Specifications to cover payments for forest improvement practice are proposed by the author.

THE new Agricultural Conservation Program, which is being initiated this year to replace the invalidated Agricultural Adjustment Program for extending aid to agriculture in the current unbalanced economic situation, is of far-reaching significance to plant scientists and foresters. Although this program originated out of economic necessity with a strong political background, it bids fair to be a major stimulant to the widespread application of the results of scientific research in agriculture and forestry.

For our purposes it is not necessary to discuss the wisdom or soundness of the act itself. Having been framed with the experience of the ill-fated Agricultural Adjustment Act fresh in mind, there should be no question as to its constitutionality. With the new act written into the law of the land, our interest will be in considering certain possibilities in its application, especially the possibilities in relation to forestry. The ideas to be presented are the personal views and suggestions of the author, intended to focus attention and stimulate discussion on the place of forestry in the new program. At the time of writing, the official position of the Forest Service in this matter has not been defined, and it is not known to what extent the proposals advanced would meet with the approval of those who are responsible for the administration of the act.

Origin of the Program

For a clear understanding of its objectives, a brief statement of the origin of the act is in order. The basic objective of the Agricultural Adjustment Program was to raise the price of the major agricultural crops to a point which would establish reasonable parity between the purchasing power of the farmers and that of the industrial element by adjusting production to an amount commensurate with available markets. Restriction of production was necessary because monetary conditions and other factors had greatly reduced the amount of goods which this country could sell abroad.

Long before the A.A.A. was declared unconstitutional, the Department of Agriculture had advanced the hypothesis that the problem of agricultural adjustment in this country might logically be considered as parallel to or concomitant with the problem of economic land use. It was suggested that if the land definitely known to be submarginal for agriculture were removed from production, if land subject to severe erosion were no longer planted to soil-depleting crops, and if all major

[1]Address before Plant Science Club, Yale University, May 11, 1936.

crops were grown on lands where they could be produced most economically and without soil erosion, the problem of agricultural adjustment would be automatically solved; at least such adjustment of land use in the interest of soil conservation and good farm management would go a long way toward adjustment of production to potential markets. And so, last summer, the cooperation of all the agricultural experiment stations and land grant colleges was enlisted in an effort to estimate what adjustments in acreage and volume of crop and livestock production would be involved if good farm management practices and conservation of agricultural resources were to dictate the use to which the land is put. It was recognized of course that in the application of results other factors, such as trends in consumption of various commodities, proximity to markets, international trade prospects, and possible future changes in dietary standards of the people of the United States, would have to be taken into account.

Translating the results of this survey into actual practice would mean a material increase in the production of hay, some increase in area of pasture, and some decrease in the production of feed grains. This would imply a shift away from hogs, which consume relatively large amounts of grain in proportion to hay and pasture, and toward cattle and sheep, which consume less grain in proportion to hay and pasture. This shift would be consistent with the results of nutritional studies which suggest increases in consumption of dairy products and lean meat and decreases in consumption of fat meats.

Another result of the survey standing out clearly, as anticipated, is that some areas of low productivity should be retired, in whole or in part, from farming, either because that is the only way to control erosion or because productivity is so low that continued use for crop production is unwarranted. It has been suggested that these lands be devoted to forestry, but no consideration was given in this study to the economic use of farm woodlands.

When the results of this project were released last November, it was stated that, in addition to the need for more research on technical aspects of the problem, it would be necessary to develop methods of implementing and administering a nationwide agricultural adjustment program based on the concepts underlying the survey. Within a few months after the completion of this project the A.A.A. was invalidated, and the Department was forced to evolve a substitute plan.

From this it will be seen that the new program, brought forth, to be sure, under great pressure, in reality was not a flash in the pan or something grasped in desperation as a drowning man clinging to a straw, but rather the fruition of much detailed study extending back many months. Speaking with considerable optimism at this early stage in its development, it may be said that the new plan presents the opportunity for advancing rapidly toward the objective of desirable adjustments in land use and widespread application of scientific agriculture, as a substitute for what was admittedly an emergency procedure, arbitrary in its application and difficult to enforce.

Scope of the Act

Although in the framing and application of the new act the primary consideration probably has been a method of continuation of cash payments to farmers in order to reestablish parity between the purchasing power of the farmers and those not on farms—the so-called tariff substitute for agriculture—reading of the act will disclose that its basic objective is in reality economic land use and the application of the results of the regional adjustment project carried out last summer.

If the program is successful, it should

clear up the anomaly of striving to increase productivity through scientific research at the same time that apparent overproduction of basic commodities is upsetting the economic balance. Production may be expected to be on a more economic basis if land unsuited for any particular crop is withdrawn from such use, and the application of improved practices should enable the farmer to get a better return for his labor and thus compete more effectively, no matter what the price basis may be. Efficient production on lands best suited for the purpose sounds very much like the application of sound industrial management to agriculture.

The act lists five specific purposes or objectives:

1. Preservation and improvement of soil fertility;

2. Promotion of the economic use and conservation of land;

3. Diminution of exploitation and wasteful and unscientific use of national soil resources;

4. The protection of rivers and harbors against the results of soil erosion in aid of maintaining the navigability of water courses and in aid of flood control;

5. Reestablishment of the 1909-1914 ratio between the purchasing power of the farm population and that of the population not on the farms.

The method of achieving the objectives of the act is the payment of benefits in cash to farmers for diverting land from soil-depleting crops to soil-building or soil-conserving crops, and for the application of desirable soil-building practices on either diverted acreage or other pasture and crop lands. The soil-building measures for which payments are to be made in the northeastern states this year include improving established pastures, hayland, and sod in orchards by the application of specified amounts of lime and fertilizer; establishing new seedlings of grasses and legumes, growing green manure crops, mulching orchards, and planting forest trees.

The amount of payment varies from one to several dollars per acre, depending on the cost of the soil-building practice used. In general the rates represent half to three-quarters of the cash cost. The maximum amount which can be paid to any one farm is equal to $1 for every acre on the farm actually devoted to soil-conserving crops, but woodland is not counted in determining this limitation. Payment for diverting land from soil-depleting crops such as corn, potatoes, and tobacco, to soil-conserving crops, such as grass, legumes, and forest trees, will average about $10 per acre, with a limitation of payment fixed at 15 per cent of the crop land in each farm.

It is obvious that simplicity of operation will be essential for success. Simple and easily understood limitations for payments must be set up. The practices which will qualify for payment must be clearly defined, and compliance must be subject to simple yet positive inspection or check.

Research agencies are being called upon to classify crops according to soil-conserving values and to supply the basic technical details for desirable soil-building practices. The challenge to plant scientists in fields which come within the scope of the act is clear. To the extent that the scientist can reduce the results of his research to clear-cut practical specifications for improved practices, he may expect the whole weight of the new program to come into play for widespread application of his work. But the interrelation of all factors, both biological and economic, must be considered; recommended practices must not open the way for insects or disease, or otherwise upset natural and economic balances. In the latter category may be mentioned the necessity of guarding against setting up or aggravating destructive interregional competitive situations.

Precedent for Federal-Aid Policy

For this year and next, payments will be made direct from the federal government to the farmers, but beginning with 1938 the plan is to be administered by and through the states. It may therefore be considered a new addition to the long and growing list of activities which have been sponsored and stimulated through the device of federal aid to the states. In the decision of the minority of the Supreme Court in the Schechter case, it was stated that the logic which invalidated the original A.A.A. would require repudiation of the whole philosophy of federal aid to the states, and that accordingly federal-aid activities could only continue because they had never been challenged. But it is my belief that this policy has become so firmly entrenched and has had such constructive results that it is in no danger of being successfully challenged at this time.

To obtain a picture of the extent and diversity of federal aid to states, consider the list of activities financed in this way during the fiscal year 1933 (Table 1).

Since we shall be primarily concerned with forestry in the application of the new act, we may use the results of federal cooperation in forest fire protection and extension work in forestry to illustrate how effective the federal-aid policy has been (Table 2).

Table 1

Federal aid to states, f. y. 1933

	Amount	Per cent
Highways	$125,000,000	68.6
National Guard	31,264,000	17.2
Vocational education	8,415,000	4.6
Cooperative agricultural extension[1]	5,760,000	3.2
Agricultural experiment stations[2]	4,374,000	2.4
Agricultural colleges	2,550,000	1.4
Forest fire prevention, nursery stock, and extension	1,761,000	1.0
Other	3,106,000	1.6
	$182,230,000	100.0

[1]Increased $8,000,000 in 1935 under Bankhead-Jones Act.

[2]Increased $600,000 in 1935 under Bankhead-Jones Act.

Expenditures by the states have grown by leaps and bounds under federal stimulation, and the results in both area protected and public appreciation of forest values have been most gratifying.

Application to Forestry

As a background for considering the possible application of the Agricultural Conservation Program to forestry, it is important to emphasize the significance of farm woodlands in the rural economy of the Northeast.

In the New England and Middle Atlantic states together, 50 per cent of the entire land area is forested. In these states there are 17 million acres of farm woodlands, and these constitute about one-third of all privately owned forest land. In these states from 20 to 60 per cent of the land in farms is woodland. The farm woodlands constitute a self-contained source of fuelwood, fence posts, and often of logs to be sawed locally into lumber for building construction and repair. They are also in advantageous position to supply timber for the major consuming markets in the large centers of population. The northeastern states are dependent upon other regions for a very large part of their timber requirements, New York, for example, importing 83 per cent of its hardwood lumber consumption and 98.7 per cent of its softwood requirements.

Under conditions which prevail in the Northeast, many farms which no longer will maintain a family at a satisfactory standard of living as strictly agricultural enterprises may be successfully operated if a relatively limited source of supplementary income is available. The farm woodland, if properly managed, may supply such income. It not only provides employment for men, teams, and equipment in the woods, and cash income for stumpage, but may sustain local industries

and so benefit rural communities in a very fundamental way.

Yet it must be conceded that, by and large, farm woodlands are not functioning properly in these respects, and conditions as to forest management and utilization are far from satisfactory. The very factors which should increase farm woodland values appear to have militated against them. Successive waves of unrestricted clear cutting, prompted largely by heavy demands from adjacent industrial populations, have depleted the available growing stocks to a point where many wood-using industries have been forced to move to other regions, and those remaining find little timber of attractive quality. As a result, farm woodland owners now have little opportunity to dispose of their timber except in lump sums to portable-mill operators. The portable mills which convert so much of the timber in the region are notoriously wasteful and inefficient. For this reason, if for no other, they must obtain their stumpage at exceedingly low prices; and returns to woodland owners not only are generally unsatisfactory, but are realized only once in several decades.

This situation can be altered by the encouragement of practices which will restore and maintain a sufficient volume of standing timber of merchantable size and desirable quality as a growing stock to afford a continuous supply of raw material for stable and permanent forest industries.

An alarming aspect of the unsatisfactory farm woodland situation which has just been outlined is the fact that, while forest industries have waned, the area available for forestry has increased very substantially as a result of major changes in the agriculture of the region. The opening up of the West, the introduction of machinery for crop production, the depletion of soil fertility, and other factors have led to widespread abandonment of agricultural land throughout the region during the past 50 years; and this has not yet reached its conclusion. The abandonment of submarginal agricultural land has in fact been hastened in many localities by the decline in activity in the forest industries which formerly provided important sources of labor and markets for farm products.

The transition in agriculture which has been taking place has given rise to far-reaching questions of public policy. The very basis for the existence of many rural communities has been threatened; problems of relief and resettlement have been created, and the ability of private ownership to redeem its responsibilities in the use of land has been questioned. In all the northeastern states there are strong movements toward an increase in the area of publicly owned land. In New York this has crystallized in a program which envisions public purchase and reforestation of a million acres of submarginal farm land during a 12-year period, with preliminary surveys by the state planning board indicating that there are perhaps 6 million acres more which should be retired from agriculture.

All this throws increasing emphasis on forest land use. Examination of the situation points definitely toward the condition of the forest and its management as a basic reason for the obvious maladjustment. To the extent that the problem of forest management can be successfully met, the margin of profitable agriculture will be raised and the need for public

TABLE 2

PROGRESS IN FORESTRY THROUGH FEDERAL AID TO STATES

	1915	1931
Area under cooperative protection	95 million acres	228 million acres
Expenditures—fire control	$984,000	$7,222,000
Expenditures—extension	4,000	160,000

acquisition of submarginal farm and forest land will be minimized.

The new Agricultural Conservation Program offers a means of striking at the heart of the problem by offering aid and incentive for constructive forest management. Forestry measures which may come within the scope of the act are of three kinds: (1) planting, (2) fencing of pastures, and (3) forest improvement.

Planting of forest trees on pasture and crop lands has already been recognized as a soil-building practice which will qualify for payment at the rate of $5 per acre. Requirements for compliance should specify species of trees and size of stock which will be acceptable under various soil conditions, and minimum standards of survival. Payments should not be made until the end of the first growing season after planting. Provision may be made for partial payment if survival is unsatisfactory, with additional payment in subsequent years for replacement planting to establish a fully stocked plantation.

Fencing of woodland against livestock is another desirable practice, which is of more importance in Vermont, western New York, Pennsylvania, and states of the Ohio Valley than in most of New England. The elimination of woodland grazing maintains watershed protection values, prevents soil erosion, and permits the establishment and development of seedlings to replace mature timber when cut. No technical considerations are involved in establishing specifications for compliance in connection with woodland fencing.

Forest Improvement

Forest improvement is by far the most important of the desirable practices which may be stimulated by the new program of federal aid. Under this heading should be included cultural practices of all sorts which involve investment for the future or deferment of income which might otherwise be realized at once. Weeding in seedling and sapling stages, improvement cutting, thinning and pruning in young timber, and partial cutting practices in merchantable stands would all come under this definition.

Since forest improvement has not yet been recognized as qualifying for payment, it may be well to review the specific purposes of the act to see how forest improvement fits into the picture.

Preservation and improvement of soil fertility. — Under proper forest management, humus and litter conditions of the forest floor are kept intact, organic content is built up, and the soil is protected from exposure which creates severe fire hazard and upsets the normal biological processes in the soil.

Promotion of the economic use and conservation of land.—Economic use of forest land is contingent upon rebuilding and maintaining a growing stock of trees large enough to produce merchantable material in the more valuable size classes. This can be accomplished best by light cuttings in existing stands which will remove only those trees which have fallen far below the average in vigor and rate of growth. Such cuttings can be repeated at frequent intervals—perhaps as short as 3 to 5 years, thus establishing income to the farmer at the same time his woodland is being built up. Clear cutting, which has been the general rule in the past, must be discouraged. The change involves a deferment of a substantial part of the income which might be derived from liquidation of existing values.

Cultural measures in young stands, such as weeding, pruning, and thinning, are also essential for economic use. Without such treatment, existing stands in the seedling and sapling stages, and even new plantations, may be dominated by inferior species and produce material so largely of poor quality or form as to be worthless for anything except fuel.

Conserving the productivity of farm woodlands demands systematic manage-

ment and cultural practices which are not generally adopted now.

Better use of national soil resources.—The forest crop is the only use of the soil resource on a large part of most northeastern farms. Unrestricted exploitation and wasteful and unscientific use have depleted this resource until dependent industries have shrunk to a small fraction of their potential importance. Restoration of the forest industries, with all that that means in stable outlets for products of farm woods, opportunity for employment of labor, and other community benefits, can only be effected by proper methods of forest management.

River and harbor protection and aid in flood control.—Maintenance of the permeability of soil in the woodlands, which is perhaps the most important aspect of the value of forests in the protection of streams and control of floods, is promoted by proper forest management, especially by partial cutting as opposed to stripping of the land, elimination of grazing in the woodlands, and the establishment and maintenance of desirable mixtures of softwoods and hardwoods.

Reestablishment of parity of farm purchasing power.—Farm purchasing power may be increased by raising and stabilizing the income from the woodlands through forest management and utilization practices which will rebuild depleted growing stocks, improve the quality of the timber produced, and eliminate waste and inefficiency in bringing such timber to market.

It would be difficult to interpret the objectives of the program set forth in the act as not covering forest improvement as well as pasture improvement or other agricultural practices. This possibility is of especial significance in the Northeast because the farm woodlands are such a large element in rural economy there.

Forest improvement practices should be recognized under a separate heading, which might be designated "Payments for Promotion of Forest Productivity," and should have a base independent of that established for strictly agricultural practices.

As a suggestion, the total payments for forest improvement in respect to any farm might be limited to an amount equal to 50 cents for each acre of woodland supporting a growth of desirable species, well distributed over the area, and averaging not less than 200 trees per acre of such species when less than 25 feet in height, and not less than 100 trees per acre when more than 25 feet in height; provided that any areas from which more than half of the trees over 6 inches in diameter are cut without prior approval of the state committee administering the act shall not be counted in determining this limitation for a period of 6 years after such cutting, and provided further that no annual payment to any individual shall exceed a fixed amount—say $1,000.

Such a proposal would free forestry measures from competition with other crops for funds available to each farm.

Payments for weedings, release cuttings, pruning of crop trees, or other measures in young stands might be set at $3 or $4 per acre; and payments for improvement cuttings, thinnings, or partial cuttings which yield merchantable products in excess of half their cost might be set at about $1.50 per acre. No area on which payment is made for cuttings involving the removal of merchantable timber should qualify for a second payment within a period of years equal to one-third the percentage of the basal area of trees over 6 inches in diameter removed.

Since the area of farm woodland in the Northeast averages about 28 acres per farm, forest improvement payments would not exceed an average of $14 per farm under this scheme. Aggregate payments in the New England and Middle Atlantic states could not exceed 8½ million dollars. On the average farm this would permit payment for silvicultural treatment of

3½ to 5 acres per year in young stands, or for partial cutting of merchantable material from about 9 acres, or about one-third of the entire woodlot area each year. There are about 185 million acres of farm woodland in the entire United States, but it is unlikely that more than 20 to 25 per cent of this area would qualify in any one year. On this basis the total amount of subsidy would perhaps never exceed $20,000,000.

The proposal automatically puts a premium on light cuttings at frequent intervals, which is a desirable silvicultural objective; for the lighter the cutting, the larger the payment per thousand board feet, and the heavier the cutting the longer it will be before the land may again qualify for benefit payment. Furthermore, extremely heavy cuttings not only lengthen the interval between successive benefit payments, but reduce the base on which maximum payments are computed. The partial cutting practices encouraged by a proposal of this sort are consistent with the objectives of wildlife management, and also with the maintenance of aesthetic values, both of which are important public considerations in the northeastern states.

In conclusion, emphasis may well be placed on the analogy between depletion of growing stock as affecting the economic productivity of forest land, and depletion of the soil itself in the case of agricultural crops. The result in both is a loss of productivity which requires decades to rebuild. Soil conservation is not an end in itself, but it is essential as the basis for maintenance of economic productivity of the land resource. Attention must therefore be directed to the latter for ultimate justification of the federal program. No matter what the condition of the soil may be, forest land cannot be considered economically productive unless it supports a merchantable stand of desirable species. To insure economic productivity of forest land, the program must therefore go one step further than the soil itself and include measures to build up and maintain an adequate growing stock of merchantable quality.

WHERE ARE WE IN FOREST CONSERVATION?[1]

By JOHN B. WOODS

Secretary to the Joint Committee of Public and Private Agencies

THE topic assigned for tonight consists of four questions, each one equipped with a question mark, which you may take to indicate skepticism or honest inquiry, according to your lights. I aim to give you my impersonation of a more or less competent forester trying to present a fair answer to each of those questions. The first of them provides the title for my entire paper.

1. *Where are we in forest conservation?* If we accept the latest available statistics as satisfactory, we are at a point where the area supporting forest vegetation has been reduced from an original 940 million acres to approximately 615 million. If we rule out the mountain tops and chaparral, amounting to 109 million acres, and also the 11 million acres of usable forest land set aside for park use and the like, we find slightly less than 500 million acres now classed as commercial forest. The net reduction of about 325 million acres has been subtracted from the original forest area and put to other uses, chiefly farming; but of this, possibly 50 million acres will move back into the forest-use category as farming becomes more intensive and exacting. And of the remaining forest area, all but one-fifth has been cut over at least once.

There is, of course, another side of the coin. A second fifth is stocked with sawtimber grown since the primeval forest fell, and considerably more than a third fifth is stocked with forests of cordwood size, some of which will be utilized as cordwood, but much of which will grow to sawtimber size. A fourth fifth of this area is restocking more or less satisfactorily; the remaining 80 million acres is doing pretty poorly. Our problem, then, is concerned with more than conservation; it involves improvement and even regeneration of the forest crop upon 400 million acres, plus whatever is cast off by the farmers as they search for better dirt.

Now as to ownership. If my estimates are up to date and accurate, there is now in public ownership about 107 million acres of commercial forest land. We must assume that this area will be well managed; we know there are some weak spots, but we expect that they will be strengthened. More than 125 million acres is in farm woodlands, under management ranging from high efficiency to utter disregard, but on the whole promising. I shall return to this subject later. The remainder, some 263 million acres, is in so-called industrial ownership (some of it insecurely held, tax delinquent and interest in arrears), under management of lumber and timber products operators, pulp and paper groups, mining concerns, makers of special products, and investors who either supply raw materials to these others or hope to sell their forests or the wood therefrom in the future. The greatest single class of owners is the lumber and timber products industry group.

Enlightened management by all these groups of industrial owners is desired and expected; and to us, enlightenment means methods of cutting which leave the land in restocking condition; it means also planning for long life, with permanency of industry and dependent communities as objectives. It means also strengthening of the financial grip, so that delinquent taxes may be paid and tax reversion arrested, so that bond interest may cease to be the factor restricting operating policies to quick liqui-

[1]Paper presented before the Washington Section, April 28, 1936.

dation. It means also protection of the growing as well as the mature forest, and aggressive research to broaden markets, improve usefulness of products, and lower the costs of distribution.

At the risk of harassing you by repetition of facts you already know, I shall emphasize a few more statistical points. Years ago Colonel Greeley called attention to the uneconomic location of our remaining forests; they were too far removed from centers of use. That situation has changed somewhat, but more than 60 per cent of our mature timber, a thousand billion feet—if that means anything to you, I confess it is too coarse for me—stands at a competitive disadvantage as regards markets. The Panama Canal has helped some; lower rail freight rates may help more, to open the way to more orderly and less hurried removal of these stands. Integration with public forests would help—but more of that later. Another change also is very interesting. Instead of becoming a barren waste of treeless flats and hills, the great South in two decades has become a potential yellow pine farm, now growing upon half of its pine lands (according to Inman Eldredge) 18 million cords of wood each year. As this great plant swings into production, as the small trees become big ones, the annual yield of sawtimber and pulpwood may exceed in volume the yearly output of old-growth pine in the old days. The Northeast today is growing more than is being cut. Only in the North Central and Lake States regions does growth lag behind depletion, and there the relation is very little out of balance.

To compare growth and drain on the basis of 1929 and prior years is to cling to the bad old days. Consumption declined abruptly from a 5-year average of 36 billion feet of lumber to 16.4 billion for the next 5-year period. Total forest drain for the period 1929-1934 is estimated by Smith in the N.R.A. Report as 9.5 million cubic feet per year. The same report carries an estimate of growth for the same period of 8.9 million cubic feet. We recognize that production and loss at the old rate put too great a burden upon our growing capacity. But reduced consumption and increased effectiveness of protective measures have put us practically in a state of balance. The job now is to complete the extension of management to all our lands—both public and private—and build up our productive capacity. As a practical matter, that means there must be agreement and action by 50 or more public management agencies; by 3 or 4 million farmers (say half the total number); and by about 30,000 industrial operators.

2. *What did we learn and accomplish under Article X of the Lumber Code?* You have heard the song of N.I.R.A. before. Probably you will hear it again. But not from me tonight. Suffice it to say that Article X of the Lumber Code recited that the applicant industries undertook, in cooperation with public and other agencies, to carry out such practicable measures as might be necessary for the declared purposes of the Code in respect of conservation and sustained production of forest resources. The industries requested a joint conference of representatives of public and private agencies definitely concerned with forest conservation, to be designated by the Secretary of Agriculture. They further requested that the conference make to the Secretary recommendations of public measures, which he should transmit with his recommendations to the President; that it should make recommendations for industry action to the Code Authority, which should promptly take such action; and should submit to the President necessary supplements to this Code to give effect to the declared purposes.

It is rather difficult to draw a line between the things which we learned and the things which we accomplished, be-

cause we actually accomplished a good deal in learning some of the things that previously had been a closed book. I judge that the two sessions of the National Forestry Conference were of very great educational value to all who attended, and I believe that the results accomplished were surprisingly good. I did not attend either session, but I have devoted a good deal of time to examining the written report and the Code amendments which resulted from these meetings. One extremely valuable result was the setting up of a Joint Committee, composed of an equal number of public representatives and private representatives, whose duty it should be to take promptly such action as might be appropriate to give effect to the recommendations of the Conference. The Committee went to work immediately and formulated a proposed amendment to the Lumber Code, which outlined an industry program and provided for the administrative set-up to put it into effect in the various divisions of the Lumber Code concerned with forest conservation. The Committee also formulated a program of federal and state action, following the recommendations of the Conference, and submitted it to the Secretary of Agriculture for submittal to the President. The Joint Committee then adjourned for the time being, ready to reassemble as occasion might require, to assist with the furtherance of the undertaking.

Thus there was set up a joint program with two component parts:

First, forest practices—for protection of mature timber from fire, insects, and disease, for care and protection of young growth during logging, for restocking forest lands after logging, and for the wider application of selective logging and sustained yield production. These forest practices were to be undertaken by the timber-using industries in the administration of their Code.

Second, public forest measures—for extending cooperation in the control of fire and other hazards, for the administration and enlargement of public forests, for improvements in forest taxation, for forest research, for long-term forest credits, and for other developments necessary to support the undertakings of the industries.

The first part of this program, dealing with forest practices, was forthwith put into effect by the Lumber Code Authority. Code amendments and rules of practice for each regional division of the industry were adopted. The principles formulated by the Conference were translated on a very wide front into the daily work of the woods. Twenty-six technical foresters were employed by the Code Agencies, covering nearly all forest regions, to carry out the rules of forest practice through instruction and inspection, backed by the legal authority of the Code.

Article X appeared to foresters who were acquainted with the complex problems of the lumber industry as a special dispensation of Providence, which came at a time when that industry was too burdened with problems of bare existence to make progress toward better forest management. As a part of the Lumber Code, this Article and its supplements were law, before which all persons under the Code were equally responsible. And as law, it summarily disposed of the long-continued argument as to whether one operator could afford to do the things necessary to provide for regrowth if other and competing operators did not.

There were about 27,000 operators under the Lumber Code. We were somewhat surprised to learn that only a small percentage of such operators ever had studied seriously the possibility of profitably applying forestry science to their operations. We learned also that in some regions of the country comparatively few operators understood and supported local forest fire regulations. At the same time, we found that very efficient and widely

observed regulations were in effect elsewhere. During the formulation of locally practicable forest practice rules it of course became apparent that considerable variation in such rules was not only permissible but necessary. It was shown that neither public nor private foresters had exclusive possession of the key to forest management; a period of experimentation and improvement was to be faced. There was an acute shortage of trained foresters sufficiently experienced in the practical problems of logging to conduct operations under the forest practice rules. So it became evident that the first great task after satisfactory rules were produced was to make them known and understood by 27,000 operators.

We learned that some of the federal lands, like the Oregon and California revested grants, were being denuded without any effort to apply the sustained yield principle, or to provide for restocking. We found that, on the National Forest sales of western pine and Douglas fir, selection methods sometimes were satisfactory neither from the forestry nor from the operating standpoint. On private lands managed by the Indian Service for the Indians, we found management methods criticised in one place and praised by foresters in others.

Taken by and large, but excluding the clear stands of Douglas fir, ponderosa pine, and longleaf pine, timber cutting in the United States had gradually evolved into a crude, but reproductive, selection. In western pine, some progress had been made by certain operators. Under market conditions prevailing since 1930, even this crude selection can be expected to result in fair restocking in the country east of the Great Plains. If the demand increases materially, the results probably will be less satisfactory.

Near the top of the list of accomplishments under the Code I would place the raising of standards of fire protection and spreading the belief that organized protection is essential and must be supported. The establishment of restocking provisions in the Douglas fir region and of selection standards for the several districts and associated species covered by the western pine division are possibly the two longest steps taken in the improvement of logging methods. The application of the sustained yield principle made its best record in the South, where 7 operators qualified for certification as being on a sustained yield basis, and where at least a score of others might have qualified had they been willing to stand in the somewhat exposed position of such operators. By this I mean that some operators preferred not to disclose the details of their business to the extent necessary; others did not care to secure action by their boards of directors; still others did not wish to make such commitments to local taxing authorities, although as a rule such authorities will consider the promise of sustained yield as a proper reason for moderate appraisals.

The greatest single sustained-yield enterprise disclosed was the Weyerhaeuser Timber Company's Longview, Wash., operation, with an annual rating of 350 million feet. The same company's pine operation in the Klamath area was under examination in the summer of 1935, and doubtless would have constituted the second largest. One joint sustained-yield enterprise at Susanville, Calif., was certified and should serve as a precedent for other similar combinations. An interesting example of sustained yield was found in the California Sierra, where the growth rate was extraordinarily high.

Now, of course, we recognize that the surface was only scratched in this particular province. A considerable number of western companies declined to make application. Some in the Lake states declined, and some applied but had not been certified when the Code went out.

Another thing we learned under the

Code, and with satisfaction, was that a considerable number of plants have been located in the same spot for a great many years, and have been obtaining a large part of their log supply from small holders, such as farmers and small town investors, whose woodlands have been worked over repeatedly and who have thus contributed to informal, uncertain, but nevertheless significant sustained-yield enterprises. I do not know what acreage of industrial forest land is now on sustained yield by definite policy commitment of its owners; my best guess is about 25 million acres. But I do know that there are only two ways in which even a large proportion of industrial area can be placed upon such a basis. First, of course, is public ownership, and that is impracticable for financial reasons; and second, is by making the conditions of ownership tolerable, so that people will continue to pay taxes and meet the other one hundred and one obligations incident to such ownership. Frankly, I am not nearly so much worried about the refinements of silvicultural practice as I am about whether people will continue to own forest land.

3. *How widespread and effective are private forest management efforts today?* Bear in mind that the N.I.R.A. excluded from adherence to codes farmers who were personally operating their farms, whether making hay or cutting logs. You know also, of course, that the pulpwood operators, the mining people, and the producers of other materials not included in Lumber Code jurisdiction never reached the point of making effective a Conservation Article. Thus the application of the Article X provisions was limited to less than two-thirds of the privately owned commercial forest area.

Under the Lumber Code, 27,000 operators produced theoretically 100 per cent of the lumber and timber products. At the high tide of compliance and after all divisions had had opportunity to get their technical staffs into action, it was estimated that 85 per cent by number of the persons under the Code were consciously observing the forest fire rules, and that 70 per cent by number were consciously endeavoring to observe the cutting practice rules. The first group was estimated to represent about 95 per cent of production, and the second group about 82 per cent of production. Of course, as you know, there was a considerable breakdown of compliance with most Articles of the Code during the last six months of its existence; but it is proper to state that, notwithstanding the inability of the N.R.A. to enforce this Code and the preoccupation of the Lumber Code Authority members with other matters of possibly greater urgency, compliance with Article X provisions made appreciable progress even after the handwriting was on the wall.

After the Schechter decision, the retiring executive officer of the Lumber Code Authority made certain recommendations to the directors of the National Lumber Manufacturers Association, which as you know is a federation of regional lumber manufacturing associations, scattered from coast to coast, and which, as it happens, has as constituent associations nine of the ten Agencies designated by the Lumber Code Authority as being charged with administration of Article X. The retiring executive officer recommended that the lumber industry carry on certain Code activities, because they were necessary and desirable activities. One of these was conservation.

The directors of the National agreed that it was desirable for the regional associations to carry on forestry just as nearly as possible as it had been set up under the Code, but recognizing, of course, that compliance by individual operators would be on a voluntary basis, because the Code was no longer law. The National took onto its staff the retiring chief of the Forestry Department of the Lumber

Code Authority, to act as a clearing house among the associations and as a point of contact with the government and other public forestry agencies.

Four of the constituent associations have maintained technical staffs, to carry on the educational phases of Article X work; in other words, to cooperate with State Forestry Departments in obtaining 100 per cent compliance with state laws; to educate member operators about the value and necessity of the forest practice rules; and to cooperate with federal officers and others in every proper way to put forward the public program, legislative and otherwise.

Of the other associations, three have technically trained foresters as secretary-managers; one has a forester working constantly, without pay, to improve farm woodlots, where that is the source of most of the commercial timber. One is in the formative stage, not yet strong enough to establish a department; and the tenth and last is composed of 15 members whose operations have long been conducted on a partial cutting basis. This group of associations has 910 operator members, and at the present moment it is estimated that they are producing 61 per cent of the lumber and timber products output of the country. The four associations carrying forward aggressively conservation work represent more than 75 per cent of this production.

There are some operators in these associations, of course, who have not yet seen the light; but the number is declining month by month, and I do not hesitate to say that at least half of the commercial lumber produced today is produced in conformity with the forest practice rules for the several divisions from which the materials come.

With respect to pulpwood production, I believe the proportion is as great, or possibly greater. Farm woodlots constitute a tremendous source of material and, frankly, I do not know the extent to which these woodlots are well managed. I have seen horrible examples in New England, and wonderful examples in Arkansas. Possibly you will agree that 50 per cent of the farm woodlot production is the sort of production that leaves the land in good regrowing condition.

4. *What to do about it?* What new legislation is needed to establish nation-wide forest management?

We need as much as anything state legislation to make forest ownership more attractive, revised tax systems, if you will, and better local protective systems, based on recognition that the public use of, and benefit from, forests carries an obligation to help protect them. We need federal legislation of the character already introduced in the form of the Fletcher-Caldwell Credits Bill and the McNary-Doxey Sustained Yield Forestry Bill. Such measures will tend to remove the most serious obstacles to continued private ownership.

I do not intend to argue the question of whether public or private ownership should be depended upon to supply our future forest products. I simply take the position that private ownership will be expected to carry something more than one-third of the burden, and that public ownership, in one form or another, will carry the other two-thirds or less. Preliminary to such a division of the burden, of course, must be a large program of federal and other public acquisition. This, I believe, has in it great possibilities for correcting some of the present economic ills and promoting sustained yield forestry, by using government dollars judiciously to freeze into long cutting cycles areas of mature private timber whose owners face the prospect of early and rapid liquidation.

In this proposed legislation there is evident a determination to safeguard adequately the public interest in working out these remedial and constructive measures. The same principle should apply to state legislation. I do not favor an immediate

effort to write a national forest-regulation bill, nor to have enacted 48 little N.I.R.A.'s. Of course, there is good constitutional ground for objecting to the first, but there are other serious considerations. The Lumber Code was reasonably effective for a time because of the widespread feeling throughout the industry that it was an emergency measure comparable with war legislation, and that it must be made to work. We should not discount the effect of this emotional urge, nor the difficulties of administering national forest-regulation without such an urge, or in the face of an opposite reaction.

A forester was talking with a professor of animal husbandry at one of the land-grant colleges. The good professor was so pleased over the results obtained with a certain hog feed formula that the other man—it just happened he was a forester—remarked, "Well, I should say that you have found a perfect hog feed formula." "No," replied the professor, "I once devised a formula much better than this, 60 per cent more efficient according to my calculations. The only trouble was that the hogs wouldn't eat it."

Probably we could devise a better conservation program than this which we call the joint program. Possibly we could devise 48 programs which would be better than this, and possibly we could get them all enacted during the next year or two, but I do not believe the animals would eat the ration as readily as they are now eating the one we have.

I have not said much about the progress of the public part of this program. I am not going to say much about it. It is involved with the question of the good faith of private industries to carry on their part. A resolution was passed by the board of directors of the National Lumber Manufacturers Association at Chicago last week, which I think gives fair indication of the way we are traveling. I think also that it would be most unwise to attempt to pass drastic regulatory legislation until we are able to obtain enactment of some of this long-promised remedial or encouraging legislation. Frankly, I believe that we shall desire to see enactment of forestry codes in the several states after we have had enough experience with this program to know better what kind of further legislation we need. I would like to see something that would lead toward production control, based upon actual growth and, therefore, placing a premium upon improved forest management. I am not afraid of the principle of 48 little N.R.A.'s, or one big N.R.A., but I am afraid of the results of trying to administer half-baked legislation.

Now with respect to farm forestry, I would like to see a very great expansion of the forest extension work by all the agencies which can be interested; and, of course, that means that I would like to see funds appropriated in much larger amounts than are now available. I think the cooperative idea has tremendous possibilities for improvement of woodlot management. Then there is the approach through the Soil Conservation and Domestic Allotment Act. That legislation is already with us, and remains to be applied.

By these three routes we should get somewhere with farm forestry.

I would like to see also legislation to remedy the treatment of the O. & C. revested lands; in other words, improvement of federal management. And I would like to continue to see recognition of the fact (and this recognition may appear to some to be slipping) that the experience of years in the handling of funds and men, and even of forests, cannot be satisfactorily replaced by brilliant theories, no matter how uplifting they may be, unless provision is made for wise and experienced administration. And I don't see how we can expect to have this last until we train some men for it by letting them manage forests in business competition.

THE ZONE OF EFFECTIVE WINDBREAK INFLUENCE

By DANIEL DENUYL

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THE presence of many windbreaks[1] on Indiana farms and the increasing interest in the establishment of new ones, together with the recent interest in the Great Plains Shelterbelt Project, emphasizes the need for a definition of the zone of effective windbreak influence.

During the past five years the Purdue University Agricultural Experiment Station has been engaged in a study of windbreak influences. Automatic recording instruments, including wind velocity recorders and hydro-thermographs, have been used in obtaining approximately 130,000 hours of records on wind velocity, temperature, and relative humidity. The results presented in this paper are based on these records and deal only with the influence of windbreaks on wind velocities.

Review of Literature

The literature available on shelterbelt and windbreak influences reveals many varied and conflicting statements. A brief review of some of these statements is desirable. de Carriere (11) in carrying on shelterbelt afforestation in Russia, recommended a spacing between tree belts of approximately 100 feet, indicating a rather restricted zone of influence. Approximately 10 years later Prof. Dokuchayeff (11) used a spacing between belts that varied from 600 to 1,800 feet, indicating a much wider zone of influence. N. I. Suss (11) in a handbook for Russian Personnel sets the maximum distance between longitudinal shelterbelts not to exceed one kilometer (0.62 mile), and for more arid regions 0.5 kilometer (0.31 mile).

N. P. Leontievsky, (9) in discussing the plan of shelterbelt planting in Russia, states that "this distance over which this effect of shelterbelts is felt is, according to different authors, from 20 to 30 times its height." Piatnisky (9), another Russian investigator, came to the conclusion that the zone of influence is proportional to the square in the height of the shelterbelt. Goviadin (8), in discussing "The Forest in the Service of Agriculture," states: "At a normal height of the tree, from 18 to 20 meters, the effect upon the winds in a leeward direction extends to a distance of 100 meters and in a windward direction to a distance of 200 to 300 meters from the edge of the shelterbelt."

Vyssotsky (8) is of the opinion that "well orientated shelterbelts have a positive effect to a certain distance, which one may approximately determine as equaling 20 times the height of the shelterbelt." Bogdatieff (8) concludes that "at present the greatest influence of the shelterbelt extends to a distance of 250 meters. This amounts to about 25 times the height of the shelterbelt." Another statement of Vyssotsky (13) is as follows: "We assume that the influence of a shelterbelt extends over a distance of 10 to 20 times the height of a dense closed forest stand."

Five other Russian investigators, Gorshenin, Panfilov, Godunov, Barabanshchikov, and Kolomeitsev (7), in their discussion of the influence of the height of the shelterbelts and the distance between them, state that "data now at our disposal permit us to assume that the influence of

[1]The term includes both windbreaks and shelterbelts.

the shelterbelt extends over a distance equal to 30 or 40 times its height." "At the same time, when considering the effect of the shelterbelt upon wind velocity and upon the evaporation connected with it, we have seen that both these elements vary depending on the distance from the shelterbelts." Reduction of the distances between shelterbelts is presented in Table 44, with comments as follows: "Purely theoretical calculations will show us that the surplus yield grows very considerably with the decrease in distance between shelterbelts." In discussing the fundamentals in establishing shelterbelts, the zone of influence is stated as follows: "Although we have cited many data to the effect that the sphere of influence of the shelterbelts equals 30 to 40 times their height, we shall take as a basis for our calculations a 25-fold height as confirmed by the greater number of observations."

Barth (2), in his discussion on "Wind and Means of Combat," states that "tests have proved that effectively sheltered area is 12 times the height of the actual shelter." In 1926 C. E. Flensborg (6), writing for a Danish publication, stated that a hedge furnished good protection for a distance which is 10 times the height of the trees, but favorable effects may be traced much farther away. Anderson (1), in discussing tree windbreaks in Australia, makes the following statement: "The zone of a break varies with local conditions but, generally speaking, it shelters an area equal in width to 6 to 15 times the height of the trees. A narrow strip is also protected on the windward side."

Cheyney (5), in his experimental work in Minnesota, concludes that "in every case there is an appreciable reduction at 600 feet." This checks roughly with Bates' statement that the influence of a windbreak extends for a distance of at least 10 tree heights. In his summary Cheyney (5) presents a slightly modified statement of influences by stating that "the few readings taken indicate that the effect of the windbreak upon wind velocity is quite considerable, even at a distance of 20 tree-heights to leeward." Trenk (12) in his "Farm Windbreak Handbook," writes that "experiments in the Great Plains states show that a windbreak has an influence for a horizontal distance equal to 20 times the height of the break."

Metcalf (10), in summarizing the experimental work in California, makes a definite statement when he concludes that "anemometer and production records show that the zone of complete protection extends for a distance of 5 to 6 times the height of the windbreak." Bates (3), in his early work in the Great Plains region, concludes that "actually the average distance was found to be not more than 20 times the height of the windbreak, and at that distance almost the same velocities were experienced as were found on the windward side of the windbreak." However, all the diagrams showing the various influences are shown for 1 to 10 times the height of the windbreaks studied, and not for 20 times the height.

In discussing the influence of windbreaks on evaporation, the following statement by Bates (3) appears: "The distance to which a windbreak may protect objects on its leeward side has been variously estimated at from 10 to 50 times its height. While some experiments have been carried on to determine this point, it has in general been assumed that the influence, if any, was not of great importance beyond 10 times the height of the trees." In 1934 Bates (4) states: "The question is, how much and how far to the leeward? Estimates have varied, as is to be expected when one considers the variable conditions under which such measurements might be made. It is a fairly good consensus of all observations and opinions, however, that the effect, which may amount to as much as 80 per cent reduction in velocity directly behind a good windbreak, has just about tapered out to insignificance at 20 times the height of the trees. The distance and

degree of effect may well be appreciably less than this if the windbreak is not tight. There is, in addition, quite an appreciable 'cushion' of calmed air on the windward side, if the windbreak, again, is tight near the ground."

Numerous bulletins and leaflets that discuss the establishment, care, and influence of windbreaks and shelterbelts contain statements similar to those quoted. Suggestions for locating windbreaks and shelterbelts generally recommend placing such protection at a distance of 100 feet or more from farm buildings, thus indicating a desire to have the buildings come well within the zone of influences.

The writer recognizes that he cannot correlate these various and apparently conflicting statements. It seems to him that some of the results published on the reduction of wind velocities by tree belts are based largely upon opinions not wholly supported by scientific studies. One reaches the conclusion that many statements apparently have been adapted from Bates' 1911 studies. Probably the lack of uniformity in field methods, together with local climatic variations, accounts for the variation in results.

The Russian literature (translations available) on the reduction in wind velocity by tree belts contains no discussion of methods used to obtain results, other than the measurements of the yield of crops grown within the supposed zone of shelterbelt influence, compared to yield of crops not within the zone. It is seriously questioned whether the zone of influence may be defined by a comparison of crop yields. The zone of protection should be determined by the measurement of the influence that tree belts have on wind velocity, relative humidity, and evaporation, not by the measurements of crop yield differences. Differences in crop yields are greatly influenced by cultural treatments. The writer, having spent considerable time with muck land owners who are interested in the control of soil movement, would hesitate to measure yields of muck crops grown on areas protected by tree belts and those not protected and from such measurements define the zone of influence. Other factors, such as soil cultural methods, fertilization, seeding, greatly influence the yield of a crop. Such cultural variations produce measurable differences in yields which cannot be directly attributed to windbreaks, nor to a lack of windbreaks.

Methods Used

In order to measure the influence of the various types of windbreaks on wind velocities, instruments were set up and records taken on the following types of plantings: (1) a single-row Norway spruce, (2) a two-row pine and spruce, (3) a three-row Norway spruce and American arborvitae, (4) a four-row Norway spruce, and (5) a single-row green willow. None of the windbreaks used was ideally suited for complete records, nor was it possible to vary the position of the instruments to measure all of the influences at each location. The anemometers were set up at varying heights from 2 to 10 feet in order to determine the vertical as well as the horizontal zone of influence. At each station a sufficient number of hours of records were taken, the number having been determined statistically, after much experimentation. The period of time at each location was not the same because of the variation in wind direction and velocity.

In order to determine the efficiency of the various types of windbreaks, the following scale of density was prepared and used for making comparisons:

Density 1—Nonpenetrable. Barriers such as hills, ridges, solid board fences, and paper.

Density 2—Very dense. Plantings of conifers that are branched close to the ground, with ground space completely occupied by tree growth.

Density 3—Medium dense. Plantings of mixed conifers (pines, spruce, arborvitae)

and deciduous plantings in full leaf, such as willow and osage orange hedges.

Density 4—Intermediate. Plantings of hardwoods or conifers of open form, such as white pine, or mixtures of hardwoods and conifers.

Density 5—Open. Plantings of deciduous trees in winter time without foliage, and coniferous plantings where natural or artificial pruning has taken place.

Experimental Results

The results obtained from the measurement of windbreak influences on wind velocities are shown in the following tables. The figures given are for the horizontal zone out to the points indicated, and for the vertical zone extending from 2 to 10 feet in height.

The effectiveness of a four-row Norway spruce windbreak is shown in Table 1. The percentage reductions in wind velocities are relatively constant for velocities less than 10 miles per hour. For wind velocities over 15 miles per hour, the percentages decrease with increasing distance from the windbreak. Effectiveness could not be determined beyond 6 WH because farm building arrangement did not permit set-up of instruments beyond 6 WH.

The influence of a three-row windbreak of the same density as the four-row windbreak (Table 1) is shown in Table 2. The reductions in wind velocity are approximately the same as those in Table 1. Measurements beyond the point shown in the table could not be obtained because the windbreak was located close to farm buildings.

Table 3 illustrates the effectiveness of a more common type of windbreak. The figures indicate that reductions are less with decreasing density. Comparison with the results shown in Tables 1 and 2 indicates that the efficiency of the two-row windbreak is still high.

The most complete record of wind velocity reductions is shown in Table 4. It was possible to determine the horizontal distance from the windbreak where velocities in the lee of the windbreak equaled those of the check station. It is very evident that for this type of windbreak little protection is afforded beyond 12 times the height of the shelter. For this particular windbreak, effective protection to control soil movement is not appreciable beyond 10 WH. During the 1934 adverse climatic conditions, protection was not afforded beyond 8 WH.

The reduction in wind velocities for a one-row Norway spruce windbreak are shown in Table 5. It is obvious that the protective value of the windbreak will not be appreciable beyond 2 WH. The reductions in Table 5, when compared with those in Tables 1, 2, and 4, show clearly that a shelter of density scale 5 has a very limited influence on wind velocities.

The comparative wind velocity reduction for all three types of the windbreaks studied are assembled in Table 6.

It is apparent that a shelter of density 2 has a much greater zone of effective protection than one of density scale 5.

Table 7 shows to what extent the reductions indicated in Tables 1 to 6 prevail when high wind velocities continue for a considerable period, with density scales 2 and 3.

In every case the reduction in wind velocities held for the entire period. Continuous high velocities of long duration are not common, but such occurrences are of importance during periods of extreme climatic conditions. A windbreak should provide protection during such periods.

The windward influence of a windbreak was given study. A seven months' record showed no reductions beyond a point twice the height of the windbreak. An average reduction of 10 per cent in wind velocities up to 15 miles per hour was recorded at this point, while for velocities over 15 miles per hour the average reduction was 3 per cent. Continuing high velocities were not reduced to any measurable ex-

TABLE 1

EFFECT OF A FOUR-ROW NORWAY SPRUCE WINDBREAK

Height 25′, width 50′, density scale 2

Station	Average wind velocity—miles per hour					
Check	5	10	15	20	25	30
2WH[1]	0.2	2	3	4	5	6
4WH	1	2	3	6	8	12
6WH	1	2	4	7	9	15
	Per cent decrease					
2WH	96	80	80	80	80	80
4WH	80	80	80	70	68	60
6WH	80	80	73	65	64	50

[1]Distance expressed in terms of windbreak height. Thus, in Table 1, 2WH denotes station 50 feet in lee of windbreak.

TABLE 2

EFFECT OF A THREE-ROW NORWAY SPRUCE-AMERICAN ARBORVITAE WINDBREAK

Height 25′, width 35′, density scale 2

Station	Average wind velocity—miles per hour					
Check	5	10	15	20	25	30
3WH[1]	0.5	2	3	5	8	15
	Per cent decrease					
3WH	90	80	80	75	68	50

[1]3WH denotes station 75 feet in lee of windbreak.

TABLE 3

EFFECT OF A TWO-ROW NORWAY SPRUCE-AUSTRIAN PINE WINDBREAK

Height 30′, width 25′, density scale 3

Station	Average wind velocity—miles per hour					
Check	5	10	15	20	25	30
2WH[1]	1	2	4	6	8	10
4WH	1	2	5	7	8	12
6WH	1	3	6	8	9	15
	Per cent decrease					
2WH	80	80	73	70	68	66
4WH	80	80	66	65	68	60
6WH	80	70	60	60	64	50

[1]2WH denotes station 60 feet in lee of windbreak.

TABLE 4

EFFECT OF A ONE-ROW GREEN WILLOW WINDBREAK

Height 12′, width 16′, density scale 3

Station	Average wind velocity—miles per hour			
Check	5	10	15	20
2WH[1]	1	2	4	7
8WH	2	5	8	12
15WH	4	9	14	19
18WH	5	10	15	20
	Per cent decrease			
2WH	80	80	75	65
8WH	60	50	47	40
15WH	20	10	7	5
18WH	--	--	--	--

[1]2WH denotes 24 feet in lee of windbreak.

TABLE 5

EFFECT OF A ONE-ROW NORWAY SPRUCE WINDBREAK

Height 25′, width 25′, density scale 5

Station	Average wind velocity—miles per hour			
Check	5	10	15	20
2WH[1]	2	5	8	11
	Per cent decrease			
2WH	60	50	47	45

[1]2WH denotes station 50 feet in lee of windbreak.

TABLE 6

COMPARISON OF WINDBREAK DENSITY AND WIND VELOCITY REDUCTIONS

(Station 2WH)

Av. velocity at check station, m.p.h.	5	10	15	20
Per cent decrease:				
Density scale 2	96	80	80	80
Density scale 3	80	80	73	70
Density scale 5	60	50	47	45

tent. The results obtained are for such conditions as are encountered when the wind is blowing at a right angle to the long axes of the shelter. Much of the time the wind strikes the windbreak at other angles, and under such conditions reductions in velocities are negligible. There is no "banking up" of wind on the windward side of windbreaks. Instead, the wind is partially deflected up over the shelter or filters through it.

The effective zone of wind velocity reduction depends not only upon the type of windbreak and the prevailing wind velocities but also upon the amount of protection necessary to meet a specific need. The higher wind velocities, those over 15 miles per hour, are of decided importance in measuring the protective value of the windbreak. The higher velocities also restrict the zone of influence. Windbreaks, to meet the protective needs most generally necessary, should reduce the higher wind velocities 50 per cent or more. However, the zone of effective windbreak influence will depend upon the specific local requirements. Conclusions drawn from studies in Indiana with respect to the range of effectiveness are not intended to be understood as applicable beyond the limits of the study.

Literature Cited

1. Anderson, R. H. 1931. Tree planting on the farm. New South Wales Dept. Agric. Farmer's Bull. 167. p. 7.
2. Barth, Agnar. 1934. Om vindens produksjonsnedsettende innflytelse i skogen og midlene til i bekjempe den. (Effect of wind in causing decrease in forest yields and means of counteracting it.) Grøndahl & Sons Boktrykkeri: Oslo. (Translation by C. Mygind, Div. of Sil., U. S. Forest Service, 1934. Mimeo. p. 26.)
3. Bates, C. G. 1911. Windbreaks: their influence and value. U. S. Dept. Agric. Forest Service Bull. 86. p. 45.
4. ————. 1934. The Plains Shelterbelt project. Jour. of For. 32: 978-991.
5. Cheyney, E. G. 1931. Establishment, growth and influence of shelterbelts in the prairie region of Minn. Minn. Agric. Exp. Sta. Bull. 285.
6. Flensborg, C. E. 1926. Hegns og Laeplantning. (Hedge and shelter planting.) Hedeselskabets Tidsskrift 1926: 333-338. (Translation by H. Rann, Div. of Sil., U. S. Forest Service, 1934. Mimeo. p. 2.)
7. Gorshenin, N. M., Y. D. Panfilov, N. Y. Godunov, A. S. Barabanshchikov, and P. E. Kolomeitsev. 1934. (Forest and agricultural improvement in the irrigated trans-Volga region.) Exps. & Investigs. All-Union Research Inst. for Silviculture and Forest and Farm Improvement 4: 5-143. (Translation by C. P. deBlumenthal, Div. of Sil., U. S. Forest Service, 1934. Mimeo. pp. 20, 22, 30.)

Table 7

Duration of wind velocity reductions at stations 2WH, 4WH, 6WH

Density scales 2 and 3

Duration, hours	Range of wind velocity at check station, miles per hour	Average hourly wind velocity for period, miles per hour	Percentage of reduction in wind velocity due to windbreak
5	20 to 30	25	50 to 80
6	12 to 30	17	50 to 80
7	10 to 30	15	50 to 80
8	10 to 25	14	60 to 80
12	10 to 20	14	60 to 80
14	11 to 18	14	60 to 80

8. Goviadin, Z. 1933. (The forest in the service of agriculture.) All-Union Research Inst. for Silviculture and Forest and Farm Improvment (VNILAMI): Moscow-Leningrad. (Translation by C. P. deBlumenthal, Div. of Sil., U. S. Forest Service, 1934. Mimeo. pp. 5, 8.)

9. Leontievsky, N. P. 1934. (The role of shelterbelt planting in raising agricultural yields.) Jour. Geophysics (Moscow-Leningrad) 4: 127-140. (Translation by C. P. deBlumenthal, Div. of Sil., U. S. Forest Service, 1934. Mimeo. p. 2.)

10. Reed, H. S., and E. T. Bartholomew. 1930. The effects of desiccating winds on citrus trees. Univ. Calif. Agric. Exp. Sta. Bull. 484.

11. Suss, N. I. 1933. (Agro-silvicultural rehabilitation projects. A handbook for the personnel of the staff of superior and medium qualifications for the works carried on in the Lower Volga region.) Moscow-Leningrad. (Translation by C. P. deBlumenthal, Div. of Sil., U. S. Forest Service. 1934. Mimeo. pp. 45, 66.)

12. Trenk, F. B. 1934. The farm windbreak handbook. Wisc. Univ. Coll. Agric. Ext. Serv. Circ. 267.

13. Vyssotsky, G. N. 1929. (The role of the forest in increasing the yield of farm land.) Lesnoie Khoziaistvo 10: 19-44. (Translation by C. P. deBlumenthal, Div. of Sil., U. S. Forest Service. 1934. Mimeo. p. 5.)

THE INFLUENCE OF SHELTERBELTS OVER THE MICROCLIMATE OF ADJACENT TERRITORIES

By V. BODROV[1]

FOREST shelterbelts introduce considerable changes in the microclimate of adjacent territories. In the first place, they serve as a mechanical obstruction to the wind, reducing its velocity and changing its behavior. Under the influence of shelterbelts, turbulence is increased and new whirls are formed. The horizontal and vertical components of the air are changed, the first being decreased while the second is increased. The higher the velocity of the wind in the steppe, the more marked are these changes.

Shelterbelts 17 meters high reduce the wind velocity for a distance of 1 kilometer by 20 per cent on the average when the velocity in the steppe reaches 2.5 to 3.0 m. per second. The reduction is 30 per cent with a velocity of 5 to 6 meters per second.

The vertical changes depend upon the density of the shelterbelts. The whirls increase with the density of the belt, and the latter causes a more thorough mixing of the upper layers of air with the lower ones.

Changes in wind also cause changes in all of the principal meteorological elements, such as atmospheric moisture, temperature, and evaporation. The influence of shelterbelts over these elements coincides with the daily changes of the weather. By ignoring this fact, as was done lately, we cannot get a full picture of the process, and so may be led to arrive at only general results which often are of little or no value.

In adding up the results from two definitely contrasting influences due to two different types of daily weather records, we may arrive at the conclusion there is no influence, and do this without noticing the effect.

The nature of the changes in the elements of microclimate produced by shelterbelts depends primarily upon the time, wind velocity, shelterbelt design, and the distance over which they are employed.

Changes in temperature depend mainly on the daily weather changes. These are fully connected with the balance of warmth on the external "active surface." During the first half of the day, when the balance is positive, the shelterbelt produces a warming effect. During the second half of the day, from about 3 p. m. to sunrise next morning, when the balance is negative, the shelterbelts produce a cooling effect.

The clearer and the dryer the weather, the greater is the daily temperature amplitude, and the more marked are the two influences produced by belts. During very hot days the temperature in the zone adjacent to the belt may rise 6 or 7 degrees C.; such a rise may have an unfavorable effect upon the growth of agricultural crops, and in conditions of extremely high temperature may cause "sun scald."

Due to the fact that there is a drop in the temperature during the evening and night hours, there is some danger of frosts within the sheltered space. But this concerns only local frosts which are due to overcooling, through radiation. The danger of frosts that are related to the motion of cool air masses will be reduced under the influence of shelterbelts, and the possibility of their occurrence on the sheltered territory will be less.

Shelterbelts of an open design produce smaller changes in the temperature than dense ones.

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The changes in atmospheric moisture due to shelterbelts occur in full dependence with the daily progress of weather. The most marked positive influence of forest shelterbelts appears to be during the second half of the day, when the warmth balance on the surface of vegetation is negative.

During the hours of sunset (when the weather is dry and hot), the deficit in moisture may drop under the effect of shelterbelts on the average 15 per cent over a distance of 1 kilometer, while the drop at the points close to the belt may reach 50 to 60 per cent.

During the morning hours, when the balance of warmth is negative, the influence of shelterbelts becomes opposite, as at that time they produce a drying effect on the air. As a result of this the moisture becomes less, and the moisture deficit soon after sunrise may rise on the average by 20 per cent over 1 kilometer distance between shelterbelts.

At midday, when the balance of warmth becomes somewhat balanced, the shelterbelts begin to produce favorable effects. In dry and hot weather they increase the atmospheric moisture to a distance of 500 to 600 meters. Furthermore, under the influence of vertical mixing of air masses, the moisture falls below that of the air in the open steppe, but remaining, on the average, equal to it.

The shelterbelts of an open design do not produce unfavorable effects.

Evaporation may serve as a best example of the efficiency of shelterbelt, as it is a factor which determines the dryness of a climate. The influence of shelterbelts on evaporation extends over a distance exceeding 60 times the height of the belts with wind velocity in the steppe of 2.5 to 3 meters per second, and by 100 times with a wind velocity of 5 to 6 meters per second. Within a one-kilometer plot over the open and surrounded by shelterbelts 17 meters high, the saving in moisture due to decreased evaporation amounts to 17 per cent of the total with wind velocities of 2.5 to 3 meters per second, and 25 per cent with velocities of 5 to 6 meters per second.

The influence of forest shelterbelts increases in direct proportion to their height. In the case of young shelterbelts not exceeding 5 meters in height the influence may not be greatly marked, but they are nevertheless favorable. The influence of young belts is similar to that of the old ones.

The Rostashovo Shelterbelts, which are 10.5 meters wide, produced quite favorable influences on the elements of microclimate on the adjacent protected territory. All these shelterbelts are designed with certain openings in the belt. These enable part of the wind currents to pass through the obstruction and so reduce the temperature amplitude and prevent the inflow of the upper and drier masses of air.

SOME NEW NURSERY EQUIPMENT

By A. L. McCOMB[1] and H. A. STEAVENSON[2]

INCREASED tree planting brought about by the enlarged conservation program in progress has resulted in the establishment of numerous forest tree nurseries.

As contrasted with past planting practice, current plantings are using a much larger proportion of hardwood species. Nursery production of hardwoods differs from the production of conifers in that generally only one or a maximum of two years is necessary to produce hardwood nursery stock of adequate size, while from one to five years is necessary for coniferous stock. For this reason the somewhat standardized nursery practice used in growing conifers cannot properly be applied to hardwoods.

Methods used in the past for producing hardwood nursery stock have varied greatly among different localities, and have been quite inadequate when viewed from the standpoint of economical production of planting stock well adapted to field planting on adverse sites. Lack of mechanical devices to aid in planting, cultivation, and digging have been major items in increasing costs.

Upon the establishment of the Erosion Control Nursery[3] at Ames, Iowa, in 1934, a search was made for a better type of mechanically powered nursery equipment This search resulted in the introduction to forest nursery practice of a tractor-seeder adapted to the row seeding of hardwoods, and of a tractor-cultivator adaptable to a wide variety of row-planted nursery stock. In addition a new type of tree-digger for conifers and hardwoods was developed.

Factors Influencing Selection of Equipment

Where both conifers and hardwoods are being grown in the same nursery (as at Ames), it is desirable from the standpoint of economy and simplicity to use as nearly as possible the same nursery equipment and cultural practices for both types of stock. A consideration of factors involved in growing desirable hardwood nursery stock seemed to indicate that a higher percentage of the better grades could be produced most economically when grown in rows. Conversely, past practice developed for the culture of the more northern conifers points to the use of broadcast beds.

Because of these essential differences in cultural practices between conifers and hardwoods, the only cultural operation for the two types of stock which would permit using the same equipment was the digging operation. To accomplish even this it is necessary to grow hardwoods in row combinations which would approximate in total width the standard four-foot conifer beds. Hence a decision was made to grow hardwoods in rows running lengthwise of a four-foot bed or unit, and to have each bed separated from adjacent beds by about a two-foot path or way. The number of rows per bed or unit was governed by the kind of seeding and cul-

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[3]Since April 15, 1935, Soil Conservation Nursery. Maintained cooperatively by the Soil Conservation Service, U. S. Department of Agriculture, and the Iowa Agricultural Experiment Station.

tivating equipment obtainable. The row spacings finally adopted are illustrated in Figure 1. There are four rows per bed, and the spacings between the rows in the bed are respectively 14, 18, and 14 inches. Such spacings permit mechanical seeding and cultivating of hardwoods and the use of the same digger for conifers and hardwoods.

Deciduous Seeding and Cultivating Unit

A survey of existing seeding and cultivating equipment was made with the hope of finding mechanical equipment which would reduce costly hand labor to a minimum and be adaptable to the bed unit to be used. The search revealed a wide variety of garden and sugar-beet seeders and cultivators, but none was particularly well adapted to the need at hand, largely because of the widths of rows involved. The equipment finally settled upon was a multiple-row seeder and cultivator developed jointly by the makers of Planet Jr. garden implements and the makers of Farmall tractors. The unit consisted of a Farmall-12 tractor with rubber tires, and a four-row seeder and cultivator, the latter two pieces of equipment being interchangeable on the F-12 tractor. Both the seeder and the cultivator units are fitted for attachment to gangs which are bolted to the front of the tractor. These gangs are four in number, and two gangs parallel the frame

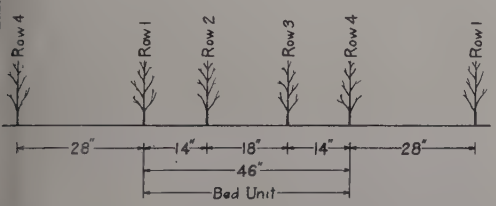

Fig. 1.—Bed unit for cultural operations. Digging tractor straddles the bed. Seeding and cultivating tractor straddles bed with rear wheels; front wheel runs between second and third row.

of the tractor on each side. When either the seeder or the cultivator is attached it rests between the front and rear tractor wheels, the inside parts being under the tractor frame. In operation the rear wheels of the tractor straddle the bed unit of four rows, while the one front wheel of the tractor runs between the second and third rows in a bed.

The seeding assembly (Fig. 2) consists of four standard Planet Jr. seeders, which are joined together by spacing bars. The seeders are then bolted to the gangs of the tractor-cultivator as previously described. Each seeder acts independently in seeding, thus enabling seeding on somewhat uneven ground. Each seeder is equipped with an adjustable depth planting shoe, gage wheels, and a set of plates each of which has a variety of holes for use with various-sized seeds. Seeds varying in size from mulberry to Kentucky coffee tree can be successfully seeded with this equipment. Other seeds sown at the Ames nursery include black locust, honey locust, caragana, Osage orange, Russian olive, hackberry, and various species of plum and chokecherry. Additional equipment in the form of disc ridgers is available if it is desired to throw a ridge of soil over the planted seeds.

The seeding and cultivating assemblies, as originally purchased, could be adjusted to fit row spacings of 18, 20, or 22 inches. The seeding unit by itself is adapted to a wider range of row spacings. A small amount of cutting and refitting was necessary, however, to fit them to the 14-18-14 spacings decided upon.

The cultivating assembly (Fig. 3) can be used in cultivating all types of small nursery stock, provided the planted rows are correctly spaced. The cultivating unit consists of four tool-bars to which can be bolted various combinations of hoes, sweeps, and teeth. To put the cultivator into use the seeder is detached and

the cultivator units are bolted to the previously described tractor gangs. As with the seeder, the individual tool-bars and cultivating implements float independently on the gangs. Three or more additional sweeps can be attached on the rear of the tractor to loosen soil packed by the wheels.

Advantages of the Tractor-Seeder-Cultivator Unit

The chief advantage of this equipment is its speed and accuracy of operation. Table 1 shows pertinent operation data. During the 1935 sowing season the tractor-seeder with two men sowed 16.5 acres of nursery to four different tree species while 15 men were hand-seeding 3.5 acres to one species. On well prepared ground it is possible to seed as much as an acre per hour. The seeding unit gives very uniformly spaced rows, and since the units are attached to the frame, there is no side sway. The unit also permits of very uniform and easily regulated sowing rates and a uniform sowing depth. The seeding and cultivating units are both between front and rear tractor wheels and in front of the driver, thus enabling complete observation of each in action. The cultivator units work with a speed equal to or greater than the seeder. In addition the cultivator (by using narrow cultivator teeth) can be used as a trencher for use in setting cuttings.

The chief disadvantage of the complete unit is that the rubber tires of the tractor have a slight tendency to pack a heavy soil. This difficulty can be obviated by using the new type of skeleton wheel. The seeding units are not adapted to sowing some seeds, such as oaks, walnuts, and hickories, or to such seeds as ash and maple unless dewinged. Great care is necessary in cultivating very narrow rows to avoid plant injury.

Table 1

Nursery culture data

Equipment	Work done, bed-feet[1]	Time	Men needed
Seeder	Ave. 3,000 Max. 6.500	1 hr.	2
Cultivator	Ave. 4,500 Max. 9,000	1 hr.	1
Digger	Ave. 3,500 Max. 5,800	1 hr.	1 or 2

[1] 1 bed-foot is equal to 4 row-feet.

The Digging Unit

The tree-digger was developed for use on both conifers and hardwoods. Most tree-diggers in use are of the single-row type, or of the Smith or modified Smith type, which is not adapted to hardwood stock because of the scant clearance under the strengthening crossbeam. The digger in use at Ames (Fig. 4) is of

Fig. 2.—Tractor-seeder combination.

Fig. 3.—Tractor-cultivator combination.

the multi-row or bed type, with adequate clearance for hardwood stock. It was developed with the aid of the Agricultural Engineering Section[4] of Iowa Agricultural Experiment Station and the Killefer Manufacturing Corporation. The latter firm built the digger.

The digger was made by modifying an existing beet-lifter. The modification consisted of attaching a horizontal blade to the standards which formerly held the beet-lifters. From these standards additional braces were extended to the frame. Lastly, the axle was lengthened to permit the digger to straddle the bed units.

The digger is very heavily built, and a screw penetration control permits setting the cutting blade at any depth from zero to fourteen inches. The blade is adjustable so that it can be pitched for digging, or held flat for root pruning. Subsoiler points on the standards give the blade adequate, quick suction. In addition, the digger is equipped with a power lift which will hoist the blade out of the soil at any desired point, while a trip allows it to fall to the ground.

Fig. 4.—Tractor-digger combination.

An adequate power unit is needed to haul such a digger. The power used is furnished by a crawler-type forty-horsepower tractor with wide tracks. This tractor has crawlers spaced widely enough apart to allow it to straddle the bed unit. Thus a direct hitch is possible, and the large surface area of the tracks gives excellent traction. The tractor and digger have a short hitch and can be turned on a 25-foot roadway, thus enabling digging of successive nursery beds.

The chief advantages of this digger are:

1. The rate at which nursery stock can be lifted.
2. The ease of operation, due to the direct hitch and the power lift.
3. The low cost of the digging operation.
4. The adjustable blade, which will permit root pruning.
5. Ease of transporting the unit to separated sections of the nursery.
6. Permits the digging of all types of moderately-sized nursery stock planted in rows.

Summary

The equipment described, consisting of two tractors, a seeder, a cultivator, and a digger, makes a combination which is quite flexible. The initial investment in the complete unit amounted to about $3,400, but considering the quantity of work done, the low operating costs, and the saving in amount of hand labor displaced, the apportioned cost on nursery stock produced over even a short period of years is extremely low.

[4]Professor E. V. Collins assisted in the development of the digger plan; the idea originated with the junior author.

A BASIS FOR THE DEVELOPMENT OF A NEW ENGLAND FOREST PRACTICE

By VICTOR A. BEEDE[1]

Pennsylvania State College

ONE of the lessons that we should learn from the lumber code experience is that, highly desirable as we consider an improved forest practice to be, it will be much more readily achieved in other ways than through the articles and sections of a code or written policy. To be sure, steps toward improvement have already been taken in other regions, but there has been little impressive progress in the industrial field. This is particularly true in New England, the region with which I am most familiar. The features of a regional forest practice in New England, as elsewhere, must develop from the joint experience of individuals representing many classes of ownership in different forest types rather than from a program which can be formally adopted in a conference.

It is the purpose of this article to indicate what would seem to be common ground on which the farmer, the woodland estate owner, the National Forest Supervisor, the water company manager, and the industrial owner may stand in agreement for a start in working out measures for perpetuating not only the forest resource but each his own interests. The large proportionate area of industrial forests and the economic importance of the industries depending on these forests for their raw material make it reasonable that decision on many of these practices should rest with those who have a close appreciation of the problems of an industrial owner and how far he can be expected to go in the practice of timber culture.

That such measures should in the first place be simple and easily understood is my deep conviction, and it is with simplicity in view that I venture to state what seems to me to be a reasonable three-point basis from which there may develop a real forest practice in this region.

Cutting budgets should be based on the productive capacity of the land, not the manufacturing plant.—A plant produces lumber or pulp in the technical sense, but in the economic sense, at the opposite end of the scale from consumption, production of wood is a function of the land. The land grows the trees, and it is there that production must be controlled. The function of the wood-using plant is to convert, and at the plant conversion must be controlled. Has not much of our overproduction been rather overconversion, as well as the underconsumption of the economists? Whatever debatable there may be in that, it is still the land and not the mill which produces the trees. From the standpoint of forest economics it appears that wood production on the part of the land needs stepping up if it is to meet the actual wood-using requirements of communities and still maintain an adequate growing stock. The "drain" upon the forest I understand to be a reduction of the forest capital or growing stock, which goes on even in lean years. That it is vastly aggravated by overconversion seems hardly debatable.

Is not the only solution a correlation between mill requirements and the productive capacity of the land, dis-

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tributing the cut over a sufficiently large area so that the integrity of the forest capital is not impaired?

A recognition of the principle of availability zones.—It seems basic that distance from or availability to market must have a determining effect upon the intensiveness of the cultural measures which an owner may be able to adopt. Simplicity on remote areas, relative intensiveness on nearby areas,—these obvious degrees of availability should be definitely recognized in a zoning practice.

A recognition of the principle of selective cutting.—For northern New England this would set up average minimum cutting limits for each species, as for example 10 inches d.b.h. for spruce and 7 inches for balsam, subject to modification in local application, together with a definite provision for exceptions on those areas upon which there is a satisfactory stocking of advance growth, or upon which conditions plainly call for clear cutting.

In central and southern New England, cutting of the larger individual trees does not work satisfactorily in many of the dense even-aged hardwood stands characteristic of the region. Here recognition of the principle of selective cutting would indicate clear cutting of relatively small areas of the oldest and largest timber, and the reservation of the young and middle-aged stands—a definite effort to favor the growing stock in these intermediate age classes.

How to Safeguard Young Growth?

Supplementing these three points, the safeguarding of young growth by more workmanlike practice in felling, skidding, and swamping should be insisted upon, just as improved fire control should as a matter of course characterize our regional forest practice. These obvious provisions alone, if carried out in the proper spirit, would do much toward keeping northern New England lands generally productive. It is recognized that over a great part of this area there is an adequate advance stocking of young growth. On such lands regeneration need not be laboriously sought by skillful cuttings over a period of years. Such advance growth is an invaluable asset to an owner, providing his basis for a future cut before the harvesting of the present one. It should be treated with the consideration accorded other definite assets.

The years of effort have resulted in making the campaign toward fire protection and control so effective that today a man who is careless in the use of fire faces universal condemnation. The next task is one which likewise may take years of persistent educational effort. It is to build up an attitude toward young forest growth, among felling crews, woods workers, and users in general, which is sane and workmanlike.

Mr. Gustave Piché once told me of a proposal which he had in mind whereby at the end of a cutting season a rating card would be issued to each acceptable woods worker, based on the character of his work and his general attitude toward it. Similar in form to a union card, it would be issued at the indication of the woods superintendent and would be in the nature of a certificate of a man's woods workmanship. The holder of a Grade A Woodsman certificate, for example, could expect to get preference in applying for a job in the future. An employer of woods labor would at least know that a man presenting such a card was a man with a good record.

I believe that such a scheme would work to the benefit of superintendent and lumberjack alike, and that it would be taken seriously by woods workers. The possibilities seem to me to be obvious, and the opportunity great for company woods agents to accomplish something definite in raising the standard of woods practices to a level of common sense and

efficiency insisted upon in other everyday practices. Along with low stumps, small tops, and clean limbing, a woods inspector should insist upon a reasonable effort to prevent damage to young growth in felling, swamping, and skidding. The lumberjack would soon get the idea, and appreciate it. Some few of them do already.

The inauguration of the first simple expedients in timber culture on an industrial scale, on the everyday, routine, upriver operations impresses me as the most important thing in the field of forestry today. Is not 95 per cent of the potentially commercial forest land in New England in private ownership? And of this area is not 75 per cent owned by industrial concerns? Need more be said of the importance from an economic standpoint of this class of ownership, and of the measures which shall be developed to perpetuate the forest resource and the interests of its owners?

Simple measures of selective cutting are in effect as routine operating procedure on certain of the industrial forests of the South. Cuts are being budgeted for the ensuing year calling for the removal in a selective fashion of as little as 1,000 board feet per acre on certain sites. When, where, and under what circumstances will such simple beginnings be made on an industrial scale in New England?

While I was writing this I learned of the death of Austin Cary. In cherishing the memory of this distinguished son of Maine, New Englanders will do well to heed his teachings and his practical idealism.

Range of Hybrid Oak Extended

During the summer of 1935 specimens of Saul oak (*Quercus Saulii* Schneid.) were discovered by E. C. W. foresters in connection with stock survey and timber stand improvement activities at three widely separated stations in the Pennsylvania State Forests.

According to the records of the Arnold Arboretum this hybrid oak was previously reported from Roslyn and Hatboro, Montgomery County. These recent discoveries extend the known range of Saul oak in Pennsylvania 125 miles to the west, to a line extending from Mont Alto, Franklin County, through Monument, Centre County, to Slate Run, Lycoming County.

The specimens agree with the description in "Manual of the Trees of North America" by C. S. Sargent, second edition, 1926, page 302, and in "Manual of Cultivated Trees and Shrubs" by Alfred Rehder, 1927, page 181. Both Sargent and Rehder state that *Q. Saulii* is evidently a hybrid of *Q. alba* and *Q. montana*.

The herbaria of the Arnold Arboretum and the Mont Alto State Forest were supplied material from these specimens.

John C. Kase,
Pennsylvania Department of Forests and Waters.

THE DOUGLAS FIR LOGGER LOOKS AT SELECTIVE LOGGING

By GEORGE L. DRAKE[1]

The following paper, first presented in substance before the Pacific Logging Congress at Vancouver, B. C., in October, 1935, stirred deep interest at that time amongst foresters who heard it. The extraordinary lengths to which the term "selective logging" has been stretched in the current usage of the region is revealed in an analysis which to foresters elsewhere is a bit breath-taking. But the writer, a trained forester as well as an experienced industrial logger, is not writing with tongue in cheek. While almost any cutting practice may, on one ground or another, claim to be "selective," a sound fundamental idea is abroad, on which, however, much careful work must be done before the idea will be translated into sound, definite, and practically useful woods practices.

IN this present age, when the political doctrine or the commercial product that holds the attention of the public gains that position by concocting a slogan that catches the public fancy, the poor benighted logging industry in the Pacific Northwest lagged behind until the term "selective logging" was resurrected from out of dusty textbooks. Due to the fact that it is an indefinite phrase with a technical sound, it has become a familiar word with foresters, the public, and even the loggers. We are told that a word, to make popular appeal, should be one that is familiar to everyone, and the fact that we have had selective gear shifts in our cars, selectivity in radios, and even in eugenics, made the term selective logging a success from the start. The result is that, no matter what the problem is, selective logging is the answer, regardless of just what is meant by the term. Another reason for the popularity of this term is the fact that you can extend a minimum amount of measurable facts by application of pseudo-economics and natural laws into a theoretical picture that would almost convince your banker. The problem, then, for the unschooled and bewildered logger is to try to find out what this New Deal in logging actually is, and what it has to offer to better his financial condition and leave the woods in proper shape for future crops.

Selective logging, which implies the selection of the trees to be cut, falls into three distinct classifications.

1. Tree selection, where the cutting is based on the selection of individual trees in the stand. This may be broken down again into four subdivisions:

a. Improvement tree selection, where the object is to improve the stand by removing defective, decadent, and ill-shaped trees. Such cutting may or may not result in a profit.

b. Economic tree selection, where the trees removed are those which it is estimated will return the greatest profit.

c. Market tree selection, whereby species removed are those for which the operator has a market.

d. Salvage tree selection, where due to loss from fire, insects, disease, or windthrow, individual trees are removed from the stand.

2. Group selection, where small areas (from two to ten acres) are cut clean. This may again be broken down into subdivisions.

a. Improvement group selection, where small areas are clear-cut in order to create favorable seeding conditions.

b. Economic group selection, where the groups removed are those which it is estimated will return the greatest profit.

c. Market group selection, where the groups removed are those for which the operator has a market.

[1]General Superintendent, Simpson Logging Company, Shelton, Wash.

3. Area selection, the most commonly practiced form of selective logging, where certain areas are clear-cut, generally because the stand contains timber from which a profit is anticipated, while other areas are left uncut because of inferior species, high logging costs, or unsuitable size. This system may also be broken down into three subdivisions.

a. Improvement area selection, where certain areas are cut in order to remove decadent timber and to secure a second stand that will add increment rather than lose it, as is often the case in decadent stands.

b. Economic area selection, where the areas cut are those which it is estimated will return the greatest profit.

c. Market area selection, where the areas cut are those containing species for which the operator has a market.

We thus find that the term selective logging does not consist of any one distinct method, but can be practiced in many ways, and is not even a new theory, since the bull-team logger in his crude way practiced tree selection, and the modern steam logger practices area selection. The cruiser looking over timber for future logging chances has often practiced the first step towards some form of economic selective logging, by recommending against the purchase of timber that showed little prospect of a financial return to the purchaser. It is therefore necessary that in discussing selective logging we tie it down to the particular problem at hand, and clearly define the particular method of selective logging that is adaptable to the area. Loosely used and in a general way, selective logging may mean little. Merely to advocate selective logging for the solving of the operating problems of a forested region, or even as small an area as a section, may lead only to serious confusion.

The putting into practice of these various methods of selective logging which I have attempted to enumerate presents an equal number of problems as to the silvicultural effect on the remaining stand, the logging problem involved, the cash realization from the trees removed, and the slash disposal problem created. Another important factor involved that must not be overlooked is that in the partial cutting of timber stands, heavy windthrow often follows such cutting, with its resulting problem of salvaging the down timber, as well as that of the fire hazard, which in windthrown timber is often more dangerous than in logging slash.

Many of the proposed systems of selective logging are based on the use of different equipment from that now in use. This equipment, the greater part of which is in excellent condition, has little resale value, and to junk these machines over night would present a financial problem that many operators frankly could not meet, for as our machinery friends will testify, to buy new equipment takes real money.

Each of these various methods of selective logging creates different conditions involving phases of silviculture, engineering, and fire protection. From the engineering standpoint, in the actual logging under these various selection systems, a wide variety of equipment and methods of using this equipment must be considered. The loggers of the Northwest have been among the foremost in the world in the trying out of new equipment and methods of logging best suited to meet their conditions, and the loggers themselves have made the advances in logging technique and equipment that make possible some of the selective logging practices now in actual use.

I have attempted in this paper to emphasize the fact that selective logging is not one simple method, but rather any of several methods or systems that in reality only apply to certain definite conditions, and I hope that our friends who are not directly concerned with logging operations

will see the complexity of the selective logging problem and consequently will appreciate, as do the loggers, the need for progress along sane and proven paths. To date, with the exception of area selection, these methods are on the whole untried and still in the theoretical stage. There are great possibilities for the improvement of logging and silvicultural methods which will likely come through modification and combination of the various selective systems previously mentioned, but it will take time and experience to decide just what can be accomplished.

The fundamental idea of selective logging is sound; and there has undoubtedly been in the Pacific Northwest, as elsewhere, far too much sweeping, indiscriminate cutting, both from the standpoint of good business and from that of good forestry. Under the many different ways in which the idea of selection can be applied, a good deal of progress can be made in the future in this direction. Selective logging cannot, however, be applied in any uniform or arbitrary fashion. The whole idea is one of *flexibility*, which must be adapted to timber, topography, market, machine equipment, etc.; and the idea should be kept on this broad basis, with no attempt to convert it into a rule of thumb or specific restrictions that cannot be carried out in the region generally. The industry has shown thus far a willingness to experiment with methods leading to improved woods practices, and as these methods are proved to be sound they will without question be adopted by the industry.

The attitude of the forester and logger should therefore be to test out thoroughly these various systems under the wide variety of conditions existing in the Douglas fir region, with the object in view of perfecting systems that will produce logs at a reasonable cost, leave the woods in the best condition for regrowth, and lastly not create a fire hazard that may offset all the favorable conditions for regrowth created by the logging system; for after all, fire is the greatest problem in the perpetuation of the Douglas fir forest.

REDESIGNING PLANS OF COMMUNICATION FOR THE NATIONAL FORESTS OF CALIFORNIA

By A. A. BROWN[1] and F. W. FUNKE[2]

U. S. Forest Service

The single-wire grounded telephone line has long been the forester's chief means of communication. For his purpose it has had the advantage of being simple in principle, low in cost, and easy to build and maintain. These features have made this type of line the long-accepted means of reaching into the back country and so of uniting scattered personnel into forest organizations. As the back country has receded and as forest uses and forest organizations have grown, the old grounded trunks have often remained, with the result that they became loaded with new connections and new extensions and became more and more exposed to interference from induction from power sources, so that difficulty in "getting through" was often experienced at critical times.

IMMEDIATE need for a planning study to design a correct and balanced pattern of communication, and to fit it to the needs of each individual Forest organization, was given emphasis by the completion of region-wide fire detection plans, which required many new lookout stations at a considerable financial investment. To realize the expected returns from improved fire detection, satisfactory communication must be provided. The writers were given the task of devising a way of doing the job.[3]

Few guides existed that would permit a definite test of the capacity of a Forest communication system to meet the requirements of peak loads in fire business or of the individual capacity of any telephone circuit to give service. Our first task, then, was the development of such guides. This took the form, first, of setting up model patterns to fit the needs of two contrasting types of Forest organization, and, second, of developing a measuring stick of the capacity of individual circuits, either existing or proposed.

Administrative Models

In National Forest fire control organizations of the California Region, two theories of administrative control exist. Both have inherent advantages and disadvantages. These are known as the centralized and the decentralized types of Forest organization. In the former the Supervisor's office acts as the central clearing house of all fire activities; in the latter, each ranger headquarters serves this function and the Supervisor's office takes the role of central dispatching agency in emergencies only. Without discussing the relative merits of each, it seems probable that both types and combinations of them will continue permanently.

It is apparent that each type, strictly carried out, has very different requirements in communication needs. In a centralized system it becomes important that every fire control station on the Forest be within immediate and unimpeded reach of the central dispatcher. This means long through trunk lines to headquarters; absence of switching stations, elimination of

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[1]California Forest and Range Experiment Station.

[2]Specialist in Fire Equipment Development, Region Five.

[3]Assisting throughout the whole planning study was George S. James, junior engineer. He contributed very materially to carrying it through to success.

private connections, and more exacting provisions against overloading, since in such a set-up it becomes important that intercommunication between main trunks through switch at headquarters be feasible.

In the more decentralized system, requirements are less exacting. A clear trunk to each ranger headquarters is necessary, but can be operated through switches at ranger headquarters to the more distant stations. Within each ranger district a centralized system is set up on a small scale. Many local lines can be fully loaded and dead-ended at the ranger station. Others must provide enough reserve only to permit communication when connected with each other through switch, or with the trunk to Supervisor's headquarters. This procedure is facilitated by switching off other lines. A single trunk to the Supervisor's headquarters thus acts as the outlet for all local lines, which is frequently satisfied by existing commercial circuits. The visual distinction is that of a single central hub for the centralized system as compared to several hubs loosely connected to a central focus (the Supervisor's office) in the decentralized system.

In practice the communication needs of an individual Forest seldom met either formula exactly, yet these distinctions served to set up administrative models and to focus attention on the balance required to meet the distinctive needs of any Forest unit studied.

In general the centralized system is most needed on Forests where major forest fires are a constant threat, but is best adapted to Forests in which the headquarters location is the natural central focus of the Forest territory and its business. Consequently, both need and feasibility dictated the form of organization for which the communication system was patterned. Where feasibility dictated a decentralized scheme, features of the more centralized scheme were often incorporated so that more centralization may be built up as future changes dictate.

A Unit of Measure for Circuits

With a clearer idea of model designs underlying Forest communication systems, the next step was that of giving thought to the means of creating these designs. One particular difficulty was the lack of agreement existing as to what was a workable telephone circuit. Long habit had often produced a "telephone voice" which could override a considerable noise level. Other voices were less successful. The need was apparent for a definite unit of measure of the capacity of individual telephone circuits that would be adaptable to both existing and proposed circuits and would be independent of personal opinions.

The nearest approach to such a unit of measure is the decibel, adopted by telephone engineers for measuring the capacity of voice transmission over metallic circuits. The decibel has evolved from the efforts of speech-transmission engineers to develop a measure or relationship of sound sensation to electric power ratios. In this problem sound becomes a commodity to be transformed and transported from producer to consumer through the medium of a wire and various auxiliary apparatus. This simple conception was ideally adapted to the planning work.

From this point of view every piece of equipment in the circuit, the wire included, represents a gain or loss in the power level of the transmission, depending on the resistance offered to the power which must carry the speech from its source to its destination. Consequently, a means of accurately measuring these gains or losses permits the definite determination of transmission capacity and removes the problem from the field of qualitative description and personal judgment determinations. It offered the best means of directing the judgment in building toward the administrative models.

The decibel is based on a logarithmic relationship. If, in a uniform telephone circuit, the power level is measured one mile from the source, a certain loss in the

level is apparent. The situation may be expressed as a ratio between the power at the source and that measured one mile from it. If at further points along the line further ratios are set up, the relationship assumes the form r to the *nth* power at n miles. That is, the power ratio is an exponential function of the length of the circuit. This relationship is reflected directly in the sound level it carries. It is therefore possible to treat sound level values as simple exponents referred to a common logarithmic base. The base of the decimal system is the "bel." For convenience, one-tenth of this value, which is close to the smallest step in loudness perceptible to the ear, is taken as the unit, hence the "decibel."

These sound-level values, once determined, are simple of application. If the ratio of the two-power values is greater than unity, there is a positive gain and a plus exponent; if they are less than unity, there is a loss and a minus exponent results. Accordingly, gains or losses in db (decibels) may be added algebraically to obtain sound level values. In practice, this means the assigning of db values to all the features of a circuit that contribute these gains or losses.

These gains or losses as originally computed referred to a standard reference power level with the db values above or below this level. As used in the plans described, an arbitrary range in power levels was used. That is, a total allowable loss or load factor of 31 db was set up as the maximum dissipation of power level, with its loss in speech transmission, that not only would permit dependable talking service but also would maintain a reasonable reserve for emergency or incidental circuits.

Little attention has been given by commercial telephone engineers to the problems of the grounded circuit. It was necessary to adapt available research data to the single grounded line and to modify the system of decibel ratings. From an intimate knowledge of the equipment and facilities in common use on the Californ nia Forests, a set of decibel losses assign able to telephone installations and switche was set up. These lack a scientific basis but tests of the resulting ratings of exist ing telephone circuits against the Fores Supervisor's judgment on several of the Forests demonstrated that they were suffi ciently dependable for the purpose. The decibel losses used are shown in Table 1

Other Criteria Used

Planning standards on these two bases first the general administrative model or framework of the Forest system as a unit then individual circuit load standards for each line of the system, contributed mos to a new and systematic method of pro cedure. Many other specifications, how ever, entered into the revamping of each plan.

The more important of these were: (1) the elimination of static interference, both existing and potential, by eliminating old high resistance wire, by replacing noisy grounded lines with transposed metallic circuits, or by using rights of way free o interference; (2) reduction of delay in fire communication; (3) reduction of wire mileage by use of the most direct routes (4) rerouting of telephone lines a mini mum distance away from certain highways to meet aesthetic objections; (5) selection of telephone rights of way along existing or planned roads to eliminate foot main tenance; (6) clearing of important trunk of cooperator connections by eliminatio or segregation; (7) consolidation of head quarters systems to reduce load; (8 avoidance of bridging commercial ex change areas; (9) checking feasibility o new agreements with commercial com panies to permit best functioning of plan and (10) setting up adequate provisio for intercommunication between adjoinin Forests and cooperative agencies, and join planning of State Division of Forestr

circuits, the better to meet separate and cooperative needs in "front" country along National Forest boundaries.

Many of the specifications designed to meet existing problems and to eliminate long-standing administrative difficulties are more specific and grew with the job. Curiously, every distinctive feature of each Forest unit in organization, business, topography, history, geography, local inhabitants, climate, and forest cover seemed to be reflected in some way in its communication system, and each specification had to be reexamined in each case in the light of these distinctive features. The common standards served, however, to give order and direction so that distinctive needs and problems modified, but did not control or confuse, the planning objectives.

Planning Procedure

With this basis for the plan set up, most of the qualitative specifications which have been mentioned were developed through the working out of two model plans. These plans were for the Eldorado and Plumas National Forests, representing, respectively, decentralized and centralized types of administrative organization. The general procedure was to go to each Forest and work out the plan of development at the headquarters. Comparatively little field work in the Forest itself was attempted.

The first step was a thorough study of the existing Forest communication system. A complete and up-to-date picture of it was obtained by compiling it in bold, heavy outline to one-half-inch scale or more on a copy of the Forest map. This map alone usually attracted the Supervisor's attention to faults and inconsistencies that had not previously been impressive. As soon as it was completed, decibel ratings were computed for each circuit of the system, and the system as a whole and by individual circuits was discussed in considerable detail with members of the Supervisor's office. For the system as a whole the discussion sought to develop its history, to define the outstanding problems, and to determine the plans already made to meet these problems. For individual circuits and projects, the class, mileage, present value, condition of wire and poles, and present functioning were determined. To complete the picture, data on commercial and private telephone circuits and power line rights of way, both within and adjacent to the Forest, were separately assembled, and the Forest map showing existing and planned roads was set up for constant reference.

Table 1

DECIBEL RATINGS ASSIGNED TO TELEPHONE LINES

Unit	Decibel rating or load-weighting factor)
1 mile grounded line[1]	0.20 db loss
1 mile metallic line[2]	0.0417 db loss
Each ringer	1.00 db loss
Each tap or leg	1.00 db loss
Each repeating coil	0.50 db loss
Each switch	0.50 db loss
Receiver off hook[3]	3.00 db loss
Transmitter in use	2.00 db gain
Through exchange (power)	5.00 db gain

[1]For all practical purpose this can be called a straight line function up to approximately 60 miles of grounded line. Greater distances involve losses due to attenuation and the natural building up of the minor losses which in shorter mileages are not so prominent. This in part depends upon location of the line, whether on ridge tops or in canyons, and the local conditions of the country or Forest.

[2]As in the case of grounded circuits, great lengths of metallic circuit will introduce the losses due to attenuation. The distance of course is much greater, about 300 miles, before the losses mount at a greater rate, since in the metallic circuit the static and electric induction can be transposed out of the system. In grounded circuits, noise continues to build up until it is impossible to carry on conversation.

[3]Commonly called "rubbering." This is not a straight line function, but one of a logarithmic nature. A circuit may have a reserve of 10 db in load rating. With no "rubbering" this reserve should give very satisfactory communication, but if three receivers are off their hooks somewhere on the circuit, it will be necessary to speak loudly or very nearly shout to carry on conversation.

When all these data, which must be considered in a communication plan, had been assembled, they were organized as of two classes: (1) that subject to change or modification through the planning work, (2) that fixed by independent factors or circumstances to which the plan must be adapted. The map of the existing system, previously described, combined factors of both classes. The overlays, showing commercial telephone and power lines, and the map, showing existing and proposed roads, were entirely of the second class. The next step in procedure, then, was the separation of the data on the existing system map on this basis. Accordingly, a new map of the Forest, usually on one-half-inch scale, was prepared to show all Forest headquarters and the identity of all points within or adjacent to the Forest which must be served by communication. Boundaries of ranger districts as well as National Forest boundaries were shown on this map. Then the map of the existing telephone system was laid aside, and using this map as a base, with the overlays and road map as reference, a model scheme of communication was first of all set up without reference to the existing system. When the main features of an ideal system had been fairly well fixed in this way, attention was then given to the actual arrangement and condition of the existing communication improvements on the ground.

Each circuit of the existing system was studied, giving attention first of all to whether or not it was overloaded, then to its function in relation to the system, then to any evidence of its failing to meet the various other specifications which have been enumerated. When this had been done, the particular circuit was either transferred bodily to the new system, revised in standard, changed in routing, or combined with other circuits, as seemed to be dictated by the facts. Particular attention was given to the decibel losses represented by its load.

For example, a grounded line 40 miles in length, carrying 16 telephones, 6 taps and 2 switches, would have the following decibel rating: 40 miles grounded line 10 db; 16 ringers, 16 db; 6 taps, 6 db; 2 switches, 1 db; a total decibel rating of 33. Obviously, an excessive amount of listening in on such a line would make its service very poor, and if it was an important trunk in the communication system, a lightening of the load would be the first prerequisite to its acceptance in the new plan.

Attention was given as to whether the trunk was the most logical connection between the termini concerned. For example, did it connect an important lookout directly with his dispatcher, or a fire guard to his supervising officer? Questions in regard to the right of way were raised. Was it the most direct route? Could it be easily patrolled in maintenance? Were there any particular difficulties in the annual maintenance due to snow banks or snag areas that might require a complete rerouting? Was the wire in need of replacement? Such points as these were checked against every circuit in the old system, and the revisions and new projects gradually took form on the proposed system map. At times, when there were questions of the proper relationship of a particular circuit to the final system they were withheld from further consideration until the complete picture had been otherwise assembled.

The problem of static interference loomed as one of the major difficulties in the existing telephone systems. The elimination of this interference was one of the major needs affecting the design of the plans. It was necessary to treat it as a separate problem of individual circuits independent of the decibel ratings. Since induction and static can be transposed or drained out of metallic circuits, and since several circuits can be carried on the same poles without causing intercircuit interference, metallic systems were de-

signed for important trunks and for secondary circuits which of necessity traversed zones of interference. By means of metallic and phantom circuits it was possible to pick up and bring in to Forest headquarters a maze of radiating grounded circuits in a feeder type of system using only a few main trunks. These main communication trunks could be placed on the most logical rights of way regardless of the presence of transmission lines and other sources of difficulty to grounded circuits. Often it was found possible to obtain cooperative agreements whereby new Forest Service circuits could be carried on commercial poles without charge.

Probably the most troublesome single problem encountered was that of providing at reasonable cost for a continuance of telephone service to cooperators who had long depended upon the Forest Service system for their own communication facilities. It was often found necessary in such cases to duplicate the original circuits so as to provide a clear through-trunk for Forest Service business, and to avoid scrupulously the linking of two commercial exchange areas. This problem in itself has many ramifications.

The number of switching stations was held to a minimum, and all were eliminated from circuits where permanent provisions for switching could not be set up. None was permitted between a lookout and his dispatcher, and, though no attempt was made to duplicate satisfactory commercial facilities, the need of prompt service for fire communication often made it necessary to cross commercial exchange areas and to close gaps, to avoid routing local forest business through a long series of commercial exchanges.

Conferences on Plans

When a plan had been completed in this way and subjected to check from the point of view of cost, adequacy, administrative desirability, effectiveness in fire control, and the proper reserve and balance to provide for future development, it was brought into the Berkeley office and put in form for presentation at a final conference. Where problems had arisen involving questions of policy, such as the future administrative boundaries of the unit, or questions of the appropriate degree of centralization to meet fire control needs, alternative plans were presented.[4] At these conferences representatives of the Supervisor's office, the Regional Forester's office, and interested cooperative agencies always participated. Through the study, developed along the lines described, it was possible to define clearly the existing communication problems and to present accurately the cost and significance of the proposals set up to meet them. In this way experienced judgment could be applied to well defined issues, and definite decisions could be reached. These conferences were a distinctive feature of the planning work, adapted from the detection planning project which had preceded it.

At the conclusion of the conference, a final report was written covering the approved plan as finally set up. A description of each trunk in the plan gave its function, the details of its standard, its decibel rating, and any particular circumstances that entered into its recommendations. This final report, with the maps, is the basis on which telephone line construction is now going forward.

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[4]The rapid development of Forest Service high frequency radio equipment gives great promise of extending on a flexible means of communication everywhere in the Forests as needed. In the plans described, it was assumed that it would supplement rather than supplant the main telephone network, and that the ultra-high frequency band would be of most general application. On such assumptions many provisions were incorporated for the substitution of radio to avoid heavy telephone investments for short-season use, and often for intercommunication between administrative units. For the period during which they will be depreciated, the proposed investment in telephone systems appeared well justified on California National Forests.

Scope of Plans

Some idea of the scope of these plans may be obtained from the following summary. "M" indicates metallic circuit, "G" grounded circuit.

Total mileage old systems used: 980 M; 4,172 G. Of this, 400 miles of both classes are being reconstructed.

Total mileage of old system abandoned: 50 M; 1,280 G.

Grand total in new systems, National Forests: 3,028 M; 5,803 G.

In the new construction the following mileage by classes is provided: 1,088 miles single metallic, of which 131 miles are on commercial poles; 279 miles double metallic; 10 miles triple metallic 262 miles phantom circuit; and 1,604 miles of single grounded line. This amounts to a program of construction on the California National Forests of 5,318 wire-miles, which is rapidly nearing completion, and an additional 1,121 wire miles set up for the State Division of Forestry in the same program. As may be noted, the net effect was the conversion of many of the key lines to metallic circuits, though the grounded circuit is still prominently in the picture.

EFFECT OF REPEATED GROUND FIRES UPON STUMPAGE RETURNS IN WESTERN WHITE PINE

By E. F. RAPRAEGER

Northern Rocky Mountain Forest and Range Experiment Station

WHEN Lewis and Clark made their historic trip to the Pacific Coast in 1803-05, they journeyed over the Lolo trail and across the crest of the Bitterroot Mountains in Idaho and the western white pine country of the Clearwater. There they saw an area which contains the largest body of loggable white pine timber remaining in the United States today. A considerable amount of the Clearwater timber is young and from 120 to 150 years in age. Thus it can be surmised that when Lewis and Clark crossed the Bitterroots they saw, besides virgin pine, an area of seedlings and saplings which had taken root in vital soil, probably after a severe fire.

Many fires have burned in the Clearwater country of Idaho in the century and more since Lewis and Clark visited there. Some killed millions of board feet of timber, while others did little damage; and certain fires may have been beneficial. The beneficial effects follow fires which, in the process of destroying decadent forests, create conditions more favorable to the regeneration of high-value white pine than to that of other species.

When western white pine trees are killed, the loss is likely to be entire unless salvage gets under way immediately. Bradner and Anderson[1] have stated that timber logged more than two years after death is seldom handled at a profit. Less apparent, however, are the losses in a stand which escaped the full force of the flames and, after the fire has passed on, still retains its identity as a stand of living merchantable timber. Many of the defects in these living trees have their origin with fire.

Some merchantable stands in the Clearwater country have been scorched and scarred by repeated ground fires which crept along lazily, killing only scattered trees, but often damaging others. Fires of such light intensity have been rare since 1917, when a period of drought began; they were probably commoner in earlier years, when summer precipitation was better distributed. The occurrence of light ground fires is indicated on living trees by fire scars. Information on dates of fires can be obtained when the trees are felled by tracing these scars back to the year of their origin.

The Area Studied

In 1935 information on the dates of past fires and fire damage was obtained for some western white pine timber on a plot near Orofino, in Clearwater County, Idaho. The purpose in establishing the plot was to obtain information on stumpage conversion values for pines of different sizes and qualities; but the opportunity to study fire history and fire damage was so excellent that this also was done. The dates of known fires on the Orofino plot are as follows: 1782, 1802, 1827, 1847, and 1852. What the causes of these fires were no one knows. They may have been started by lightning or Indians, and in later years by trappers.

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[1]Bradner, M., and I. V. Anderson. Fire-damaged logs—what is the loss? The Timberman 31:7. 1930.

That the stand exists today is proof that the fires were not very severe. The plot averages 141 years in age (see Table 1), and yet after passing through the five fires it has remained merchantable and of considerable economic value. A close examination, however, shows unmistakable evidence of damage from fires. The evidence consists of fire scars and catfaces, decays, limbiness, under-stocked areas, and reduced yields.

Fire and Many-Agedness

It was somewhat of a surprise to discover the range in age among the white pines on the plot. Quite often the white pines in a stand are about the same age, having established themselves within a few years after fire swept through the former forest. The youngest pine on the Orofino plot is 90 years of age, and the oldest is 195 years, not including one 345-year old veteran. Thus regeneration extended over a period of 105 years. There is considerable evidence that the present stand was originally even-aged. In later years when fire destroyed patches of timber the burned areas seeded in from the sides, and the resulting reproduction grew even-agedly in the midst of trees which were also even-aged but of the original age class. After succeeding fires the performance was repeated, and the end result is a motley array of ages.

Scars suitable for tracing a fire back to the year of origin were not easy to find. Many trees were not visibly scarred; others were scarred but if decay had followed, as usually was the case, the rings could not be counted. When a scar suitable for counting was found, it was noticed often that the tree had been quite young (between 25 and 50 years in age) at the time of fire. Trees older than 50 years usually escaped scarring; trees younger than 25 were quite frequently killed outright, and no evidence of their existence remains today.

The average age of trees showing fire scars is given in Table 2 for the five different fires.

Loss from Understocking

There are a number of blank spaces (understocked areas) on the plot which undoubtedly resulted when fires killed trees which were later replaced with brush. This understocking came about when seedlings were consumed in the fire, when poles and saplings were girdled, and when sawlog timber died from injuries. There are other spots which, though rendered barren, restocked in later years with trees that are living today and make up the younger age classes.

To the logger who utilizes white pine timber, understocking is something besides a forestry concept. It takes money out of his pocket to log in understocked stands. It costs him as much to build railroads, motor roads, chutes, or other logging improvements in an understocked

Table 1

THE OROFINO PLOT

Location	Sec. 29, T. 37 N., R. 4 E., Clearwater County, Idaho
Area	19.2 acres
Range of tree (western white pine) diameters on plot	Up to 35 inches d.b.h.
Number per acre of western white pine trees over 9.6 inches d.b.h.	46.3
Gross volume per acre, western white pine	27,030 board feet
Gross volume per acre, all species	47,153 board feet
Age of youngest pine	90 years
Age of oldest pine	195 years (exclusive of one 345-year old veteran)
Average age of pines on plot	141 years

area as in an area where the ground is fully productive, with heavier stands per acre.

Understocking and reduced yields go hand in hand. Yields (total net growth) have been reduced because of barren or understocked spots, by loss of the volume of killed trees, and by lower growth rates in injured trees.

Just what the reduction in volume has amounted to during the last 141 years because of understocking and reduced rate of growth is not altogether a surmise. It is known[2] that when such a stand is even-aged and well-stocked it should yield a volume of 70,000 feet per acre, Scribner Dec. C gross scale, in trees 12.6 inches in diameter and larger. With managed stands of the same age, perhaps 56,000 feet per acre (80 per cent stocking) could be expected over large areas. The difference between 56,000 feet per acre and 47,000 feet amounts to 9,000 feet per acre, and might be called a deficit resulting from lack of protection during the early life of the stand.

Thus somewhere in the dim past is hidden the full story of 9,000 feet of timber (perhaps more) which does not exist today. Whether the timber ever reached the sapling stage or whether it was destroyed by fire or other agencies in infancy or maturity is something no one will ever know. The value of this shortage can be estimated as $32.40 per acre, assuming that 60 per cent by volume (5,400 feet) is white pine with a stumpage value of $6 per thousand feet.

Table 2

AVERAGE AGE OF TREES SHOWING FIRE SCARS[1]

Year of fire	Number of years since fire	Number of trees showing fire scars	Average age of trees showing fire scars	Average age, at time of fire, of trees which were fire-scarred
1852	83	3	123	40
1847	88	7	134	46
1827	108	12	145	37
1802	133	11	168	35
1782	153	3	180	27
Total and average		36		38

[1]The age of the trees was determined in 1935.

Loss From Decay Traceable to Fire

Much of the decay affecting the pines in the stand is traceable to fire scars through which the spores of wood-destroying fungi gained access to the heartwood. Stump rots and other decays, or closely related defects which seemed to be of fire origin, amounted to slightly over 2,100 feet, log scale, per acre, or 7.8 per cent of the total pine volume. Some butt logs were so badly decayed that they were totally unfit for lumber. In 26 per cent of the pines, by number, long-butts were cut to eliminate strictly cull material. Since the labor expended in making these extra cuts produced nothing but worthless logs, an increase in log-making costs resulted which amounted on the average to 12 cents per thousand feet, or $3 per acre.

Obviously enough, the figure of $3 is an extra cost originating with fire and the follow-up fungi. Likewise, the volume of cull material (2,100 feet per acre) is a direct result of fire. If appraised at $6 per thousand feet, the loss per acre because of this cull amounts to $12.60. Thus the combined loss is $15.60, which amounts to 11 cents per acre per year during the life of the 141-year old stand.

Loss from Roughness in Trees

The presence of fires also explains why some trees on the plot are limby, rough, and thus unsuitable for the better grades of lumber. These trees lack the slender,

[2]Haig, Irvine T. Second-growth yield, stand, and volume tables for the western white pine type. U. S. Dept. Agric. Tech. Bull. 323, 67 p., illus. 1932.

symmetrical bole and small branches which are so characteristic of close-grown, even-aged western white pine. This even-agedness combined with fuller stocking results in a superior development of the bole because the trees, in close competition with each other, grow to greater heights and produce longer clear lengths. From such trees high-grade logs can be obtained and, likewise, high-quality lumber.

The limbiness which characterizes certain trees is undoubtedly a result of fires which burned on the plot when the trees were young and before they had pruned themselves. Such young unpruned trees as grew on the fringes of the burned area were relieved from considerable competition for light and root space when their neighbors were killed or dying. Under these changed conditions the lower branches persisted and caused the bole to remain rough.

Since rough, limby trees produce poorer lumber, they have a lower stumpage value. The loss because of roughness is estimated at $0.25 per thousand feet for the pine, or $6.75 per acre.

Recapitulation of Losses

Three causes of loss have been described, namely, (1) understocking and reduced yields, (2) decay traceable to fire, and (3) roughness in trees. These losses are summarized in Table 3. The total loss amounts to $51.75 per acre, or to 37 cents per acre per year during the average life of the 141-year old stand.

The important point about these losses is that they originated when ground fires crept along through the forest. The figures show that even such light fires as these reduced the quantity and quality of timber on the plot considerably. Evidently complete protection from fire is essential from infancy to maturity if the aim is to grow western white pine of high quality.

Table 3

Estimate of losses originating from fire in the white pine timber on the Orofino plot

Loss from	Volume loss per acre	Value loss per acre	Loss per acre per year during average life of stand[1]
	Bd. ft. Scrib. Dec. C rule	Dollars	Dollars
1. Understocking and reduced yields	5,400 ft. western white pine 3,600 ft. associated species	32.40	0.23
2. Decay traceable to fire	2,100 ft. western white pine	12.60	0.09
3. Roughness in trees		6.75	0.05
Total		51.75	0.37

[1]The average age of timber on plot was 141 years.

A NOTE ON GERMINATION METHODS FOR CONIFEROUS SPECIES

By N. T. MIROV

California Forest and Range Experiment Station

. . . . O thou
Who chariotest to their dark wintry bed
The winged seeds, where they lie cold and low
Each like a corpse within its grave, until
Thine azure sister of the spring shall blow
Her clarion o'er the dreaming earth—

—Shelley.

GERMINATION tests of coniferous seeds are performed by foresters either for some immediately practical purpose, such as estimating the amount of seeds to be used in a nursery, or with the aim of solving some research problem, such as the influence of various media on the reproduction of a stand by seed. In both cases a similar procedure is commonly used. The seeds are sown in flats in a greenhouse or put in a germinating oven which might or might not have been "adopted by the Association of Official Seed Analysts" (3). The germination methods used by agronomists are perfectly good for the cereal and vegetable seeds with which they work. A fact that seems to be completely disregarded by many, however, is that there is a great difference between the germination behavior of cereals and vegetables on the one hand and of forest trees on the other. While seeds of the former usually give satisfactory results when sown in a greenhouse or in a germinator without other preceding treatment, the seeds of the latter, under similar conditions, often behave erratically or even fail to germinate at all. This is especially true in the case of coniferous trees.

It therefore does not follow that foresters should use the agronomists' methods without a critical consideration of their suitability for the germination of forest tree seeds.

One of the major factors in the difference above noted is that, under natural forest conditions in temperate climates, between the time of shedding seed in the fall and germination the following spring there is a more or less prolonged period of low temperatures supplemented by abundant moisture in the ground. Accordingly, in the artificial germination of coniferous seeds (and this is also true for many broadleaf species), this natural pregerminative chilling or stratification is often desirable and sometimes indispensable. Our experience with California conifers seems to indicate that while Jeffrey, ponderosa, lodgepole, Monterey, and some other pines can be germinated well without stratification, nevertheless stratification always gives a higher and more rapid germination.

There is, again, a large group of conifers in California, of both high and low elevations, which do not germinate normally unless stratified. It should be borne in mind that occasionally a lot of seed of a normally refractory species yields fair results even when germinated by conventional methods, but this is an exception rather than a rule, and there is always a possibility that the seed does not display its best germinating capacity. Wakeley (7) found this to be so in the case of slash pine. If germination of a species is not prompt, but rather scattered over a long period of time, it is a good indication that the seed needs stratification.

According to Nichols (4), there are some trees (as *Magnolia grandiflora*) where germination is decidedly lower in seeds which have been exposed to low temperatures, as compared with the conventional method; but the conifers, at least those of California, do not seem to belong in this group. Even the conifers growing in warmer parts of this country respond to the stratification treatment (Barton) (1). A few examples from our experience will illustrate this point.

This table shows that straight germination does not tell the whole story, and that unless the seeds are previously chilled to imitate the natural conditions erroneous results may be obtained.

It should be kept in mind that the mere storing of seeds at a low temperature should not be confused with stratification, which calls not only for a low temperature but also for the presence of a moist medium.

TABLE 1

COMPARATIVE GERMINATION OF UNTREATED AND OF STRATIFIED SEED, CERTAIN CALIFORNIA SPECIES

Species	Germination percentages	
	Untreated	Stratified for 3 months at 40° F.
Abies concolor	6	44
Libocedrus decurrens	28	76
Pinus jeffreyi	53	61
Pinus lambertiana	28	89
Pinus monophylla	12	49
Pinus ponderosa	11	18
Pinus sabiniana	2	86
Pinus torreyana	28	64
Sequoia sempervirens	17	25

An interesting example which occurred in the author's practice deserves special mention. In 1929 a lot of sugar pine seeds were put in a covered jar and kept at 40°F.[1] Every year a sample of the seed was withdrawn from the jar and germinated in a hothouse in order to find out how long the seed could be kept germinable. In 1935 the writer tabulated the results. These are given in Table 2.

It was rather difficult to derive any conclusion from this row of figures, but at least the last test showed that germination of the seeds after 6 years of storage amounted to 28 per cent. In order to see how reliable this figure was, a cutting test of the seed was made. It showed that the embryos in the majority of the seeds were brittle and considerably shrunken, so as to leave an air space between them and the endosperm. The endosperm itself was shrunken and partly discolored. Briefly, the cutting test did not supply the information desired in regard to the viability of the seed.

A staining test[2] revealed the fact that at least 90 per cent of the embryos were alive and potentially capable of germina-

[1]A seed storage experiment initiated by the late H. W. Siggins, Junior Forester, California Forest and Range Experiment Station.

[2]The staining test (5) is based on the fact that living tissues do not absorb certain acid dyes dissolved in water, whereas dead cells absorb them readily. The seeds are deprived of the outer coat and soaked in water over night, and the embryos are then easily removed. They are then put in 1:2000 solution of indigo carmine for two hours, rinsed in water, and the degree of staining is observed. Since the embryos lose their viability gradually, there might be in a representative sample (say 100 embryos) all degrees of staining; live embryos are not stained at all save in the places where the tissues are crushed by forceps during the extraction; dyeing of embryo tissues may be noticed either at the root end of the embryo or at the tips of the cotyledons, or again the stained spots might be scattered all over the embryo. The embryos that are completely dead are stained all over in brilliant blue color. Each species has its own peculiarities when its embryos are stained, and it is advisable to do some preliminary experimental work before the staining test is applied as a criterion for seed viability. Numerous staining tests performed by the writer have given more satisfactory results and closer correlation to germination than the cutting test. In general, if the staining test gives negative results it is a good indication—if the seeds do not germinate—that something is wrong with the germination method.

tion. It was clear, then, that the low percentage of germination was due not to the seed condition but to the faulty germination method. To verify this, three samples of 100 seeds each were tested. One sample, submitted to standard germination in the hothouse, yielded the same 28 per cent of germination. The other two samples were stratified for three months at 40°F., one in sand and the other in peat. When brought out of the cold chamber these yielded germinations of 89 and 87 per cent respectively. This test showed that in the entire previous experiment the germination method was faulty, and that entirely different results would have been obtained in all the annual tests if the seeds had been stratified to simulate the method of nature.

There has recently come to the writer's attention the article by Fisher (2) on the influence of various surface-soil materials on the germination of several Rocky Mountain conifers. Standard germination tests in the hothouse were made, and certain conclusions were drawn. The fact that the species under experiment have low winter temperatures between the time of seed shedding and germination was completely disregarded. Had the author chilled his seeds before the germination tests, the results, and consequently the conclusions, would perhaps have been quite different.

The conventional germination method of coniferous seed may also have a considerable importance in practical forestry, such as estimating seeds to be sown in the nursery beds or purchasing seeds from the dealers. While Show (6) found a good correlation between germination in the greenhouse and that in the nursery for Jeffrey and ponderosa pine (nursery germination was found to average 78 per cent of cutting test values for Jeffrey pine and 75 per cent for ponderosa pine), he was able to find no such consistency between greenhouse and nursery germination for sugar pine. Incense cedar was also found to behave erratically. To quote Show, "Parallel tests of a single lot often show wide differences in final germination."

From Table 1 it is evident that the trouble was in the method employed to test the germinability of these two species rather than in some quality inherent in the seeds themselves. The writer is inclined to the conclusion that the common observation of foresters, that germination of sugar pine in the nursery is often far superior to the germination test made in the greenhouse, is attributable to faulty methods of trial germination.

With regard to the value of standard germination practice as a guide in purchasing seeds from seed dealers, imagine a theoretical case in which a man offers a large lot of seed of incense cedar or sugar pine, mentioned in Table 1. It is obvious that the purchase of coniferous seed based on the standard test would perhaps be profitable to the buyer but rather unjust to the seed dealer.

In the foregoing, an attempt has been made to show that the conventional methods of trial germination of coniferous seeds are unsuitable for forestry purposes in that they often give erroneous results. An entirely different approach is needed,

TABLE 2

PERCENTAGE OF GERMINATION OF SUGAR PINE SEED STORED AT 40° F. ONE TO SIX YEARS

Initial test 1929	1930	1931	1932	1933	1934	1935
			Per cent germinated			
37	70	41	70	7	27	28

and seed of each particular species should be handled in accordance with the conditions under which it reproduces in its natural habitat.

First of all, the viability of the seed should be tested. For ecological purposes it is preferable to take only good seeds, which can be approximately determined by the flotation test. The cutting test may be useful in obtaining a rough approximation of the percentage of good seed in the sample, but in many instances this might be misleading and inadequate. This is especially true for stored, fumigated, or disinfected seed. For example, a lot of Parry pine purchased in 1934 from a private seed dealer was subjected by the writer to the cutting test. The endosperm and embryo appeared to be healthy enough, but the seed failed to germinate, both in a plain test and after stratification. In another instance a lot of ponderosa pine seed was treated in 1929 with 1 per cent formaldehyde solution for 6 hours, air-dried for 24 hours, and stored in a closed jar. The 1929 germination amounted to only 1 per cent. The seeds submitted to the cutting test in 1935 showed apparently good embryos and endosperms, nevertheless the germination of this lot was nil. In order to ascertain whether or not the embryos were still alive, the seeds of both species were subjected to the staining test. All embryos of the two pines stained deeply by the indigo-carmine, and thus the failure of germination was traced to the dead embryos. The implication is that "death" of the seeds could have been determined at once by the staining method.

The staining test is strongly recommended when the seeds are used as indicators of certain ecological factors. If the seeds in question are germinable, the failure or lack of uniformity in germination may be attributable to faulty germination practice. Accordingly, it is advisable to investigate each particular species with regard to its requirements for the best germination.

Up to the present time a large amount of information has been accumulated in scientific and professional publications regarding the proper methods of germination of our conifers. If no such information is available for a certain species, it is advisable to make preliminary tests and to find out the best methods of germinating the seed. By all means it is better to stratify all coniferous seeds rather than to use unstratified material. In many experiments with California conifers, not a single case was detected in which stratification of the seeds would be harmful for germination. In the majority of cases it is decidedly necessary.

The foregoing brief discussion of difficulties encountered in germination experiments of coniferous seeds has aimed to point out the undesirability of following too blindly the conventional germination methods developed by agronomists for their own purposes. It is hoped that this note will find a response among foresters engaged in germination experiments. Comments on this paper and a broad discussion of the subject would perhaps help in developing more suitable methods for seed germination not only of coniferous species but of forest trees in general.

Literature Cited

1. Barton, Lela V. 1928. Hastening the germination of southern pine seeds. Jour. For. 26:775-785.
2. Fisher, G. M. 1935. Comparative germination of tree species on various kinds of surface-soil material in the western white pine type. Ecology 16:606-611.
3. Jacobs, Allen W. 1925. Hastening the germination of sugar pine seeds. Jour. For. 23:919-931.

4. Nichols, G. E. 1934. The influence of exposure to winter temperatures upon seed germination in various native American plants. Ecology 15: 364-373.
5. Shafer-Safonova, E. Y., et al. 1934. Determination of the germinating capacity of forest tree seeds by the dyeing method. (Russian, with English summary.) Bot. Zhurnal SSSR, 19: 566-594.
6. Show, S. B. 1930. Forest nursery and planting practice in the California pine region. U. S. Dept. Agr. Circular No. 92.
7. Wakeley, Philip C. 1931. Some observations on southern pine seed. Jour. For. 29:1150-1164.

German Forestry Society Meeting

THE Deutscher Forstverein is to hold its annual meeting this year in Stettin, from August 16 to 19. On the three following days field excursions will be made to a number of state, municipal, and private forests in Mecklenburg and northern Prussia.

According to the preliminary program, the sessions on August 17 will deal with forest regulation (management plans) and forest inventories; on August 18 there will be sectional meetings on forest worker training, scientific work management, improvement of food supply for game in the forests, and the geology of the districts to be visited on the field trips, and a general session on the forestry of northern countries. The sessions of August 19 will include papers and discussions on forest sites and related ecological topics, and on forest genetics.

BRIEFER ARTICLES AND NOTES

The Question of Conservation Jurisdiction to Date

It will be remembered that Secretary of the Interior Ickes a year ago pressed vigorously for passage of the so-called "Lewis Bill" (S. 2665), to change the name of his Department to "The Department of Conservation and Works" and authorize transfer to it of all federal bureaus and other agencies having to do with conservation. On behalf of the Society, this legislation was opposed by the Executive Secretary before the Senate Committee on Expenditures in the Government Departments, and by President Chapman before the House Committee of the same name. At the beginning of the present session, the Lewis Bill was reintroduced in much modified form. It simply changes the name of the Interior Department to Department of Conservation.

The same bill was introduced in the House by Congressman Dempsey, under the designation H. R. 11642. The Senate passed the bill, and the House Committee reported it out favorably. It has been on the House calendar for several weeks. Strong opposition to it has been advanced by organizations which support the principle of a distinction between organic and inorganic conservation, as defined and adopted by the Society of American Foresters several years ago.

In May the Executive Secretary, on behalf of the Society, addressed the following letter to all members of the House:

"We are informed that the 'Lewis Bill' (S. 2665), 'A Bill to change the name of the Department of the Interior, to be known as the Department of Conservation,' was passed by the Senate on May 13, and is now before the House.

"May we strongly urge that the House take no action on this Bill. To call the Interior Department the Department of Conservation would be a distinct misnomer. That Department does not now, and never should, embrace all federal agencies having to do with conservation. Several important federal bureaus whose purpose it is to conserve the natural resource with which they deal can function far more efficiently if they remain in the department where they now are.

"Furthermore, we respectfully submit, enactment into law of piecemeal legislation like the Lewis Bill would be unwise and premature, in view of the Senate and House Committees on Governmental Reorganization, which have recently been appointed and are expected to report their findings early in the Seventy-fifth Congress, and in view also of the President's own Committee which is engaged on the same task."

This letter, it is believed, has had no little effect in holding up action on the floor of the House.

In the meantime, the so-called Kleberg Bill was introduced in Congress. This bill, with the designation of H. R. 12498, was introduced by Congressman Richard M. Kleberg, and referred to the House Committee on Agriculture. It declares that "the public interest will most effectively be served . . . . . by centering in the Department of Agriculture all federal functions and activities which involve the use, development, and conservation of the soils and the organic resources . . . . . produced by, on, or in the soils and the inland waters of the Nation. . . ." Accordingly, it prescribes that the Secretary of Agriculture "shall administer all

laws relating to the organic resources of the public domain;" directs him to classify the public domain lands and "determine the ways in which the use or uses of their soils and organic resources will best serve the public interest;" makes this classification and determination a prerequisite for his certifying to the Secretary of the Interior the specific areas which "without detriment to the public interest and welfare may be opened to entry or appropriation under the public land laws for agriculture, grazing, or timber and stone;" and makes only lands so certified subject to entry or appropriation for these purposes. Further, the Kleberg Bill transfers to the Agricultural Department the Grazing Division of the Interior Department; the Reclamation Bureau, except its purely engineering functions; and jurisdiction over National Monuments located within National Forests or other reservations administered by the Agricultural Department. The National Park Service is left in the Interior Department.

A formal hearing on the bill was held before the Committee on Wildlife Conservation, at which representatives of the National Grange and the American Federation of Farm Bureaus as well as representatives of the wildlife conservation movement spoke in support of the measure. Under date of May 19, the Executive Secretary addressed the following letter to Congressman Kleberg, and sent a similar letter to Honorable Marvin Jones, Chairman of the House Committee on Agriculture, and Honorable Wall Doxey, a member of that Committee:

"The Society of American Foresters is heartily in favor of the Bill which bears your name; viz, H. R. 12498, entitled A Bill to correlate certain governmental functions, and for other purposes. This measure prescribes and defines in thoroughly acceptable manner those principles which our Society has long held should apply in the organization of the federal government's conservation activities.

"If it is the intention of the House Committee on Agriculture to hold any further hearings, I would appreciate very much the privilege of appearing in behalf of the Society of American Foresters."

The introduction of this bill in the House undoubtedly is a sound strategic move, even though there is little prospect of its enactment into law during this session of Congress. It is a move which was advocated in the article by the Executive Secretary entitled, "Shall there be a Federal Conservation Department?" which appeared in the July, 1935, issue of the JOURNAL. Hitherto, those opposed to transfer of the Forest Service to the Department of the Interior have been always on the defensive. The Kleberg Bill no doubt will be reintroduced in Congress next winter, and all those in favor of the principles of departmental conservation organization involved will be able to muster their forces in support of affirmative and constructive action. Thus the way will be open for seeking a definite legislative enactment recognizing what are believed to be sound principles in the organization of the conservation activities of the federal government.

FRANKLIN REED,
Executive Secretary.

UNIVERSITY OF FLORIDA OFFERS TEACHING FELLOWSHIPS

The College of Agriculture of the University of Florida announces two teaching fellowships, paying $1,000 each, for the ten months, September, 1936-June, 1937, and summer camp of eight weeks in 1937. One fellowship, entitled "Ecology of the Slash Pine," is in the Department of Botany; the other, entitled "Some Phases of the Naval Stores and Cellulose Industries of the South," is in the Department of Agricultural Chemistry. The candidates must have a degree in forestry and credit

in at least eighteen hours of their respective fields of botany and chemistry.

The teaching will consist of approximately ten credit hours in the Department of Forestry. A maximum of three credit hours per semester may be carried in the graduate school toward either the Master's or Doctor's degree, according to the teaching load. All applications should be filed immediately, addressing the communication to the Dean, College of Agriculture. The State Board of Control will announce the appointment August 18.

Section Committee Report on Forest Policy[1]

The committee desires to confine its report to matters dealing with state forestry organization in the six New England states. The report of the committee of the parent Society presented by Joseph Illick, Chairman, at the annual meeting at Atlanta, Ga., on January 28, emphasized the importance of the form of organization of state forestry and conservation departments in its relation to securing permanence of tenure of office for forestry personnel, and the elimination of political influences in such state departments.

The organization found to be most effective in securing these objectives is that of a board of commissioners with overlapping terms, preferably of six years, with two to be appointed every two years; the board to have the power of appointment of the State Forester or executive, who selects his own subordinate personnel strictly on merit. This principle is effective whether or not forestry is handled separately or is combined with fish and game, waters, or minerals, or with parks. The inclusion of the governor as a member of the board tends to defeat these objectives, and the placing of the power of appointment in his hands removes all safeguards and reduces the board to a figurehead or purely advisory capacity.

The theory on which this organization functions is that conservation is a long-time job, requiring both continuity of policy and sustained technical efficiency to accomplish its ends, and therefore cannot be subjected to the vicissitudes of political shifts and turn-overs without wrecking these policies, wasting public funds, and jeopardizing the future prosperity and welfare of the commonwealth. Continuity of policy cannot be attained by the system of political appointments of single commissioners, who are seldom informed on conservation policies and who either ride hobbies to death or tend to debauch the personnel by appointing equally unfit men in important subordinate positions on the basis of party loyalty. Formulation and pursuit of long-time, sane, and progressive policies under the board system has been secured successfully in all states in which the board is properly constituted, freed from political alliances, and given control of the executive appointments.

There are but two New England states in which the board system has been maintained, namely, New Hampshire and Connecticut, and in both the state organization has been continued without a break since its inauguration, to the great benefit of the public. The system has recently been restored in Vermont.

The state of Massachusetts has never had this form of organization, and has therefore had to depend on successive individual commissioners for the dual function of formulating policies and determining appointments and supervision of administration. As a result, there never has been a professional forester in executive charge of conservation in this state, and the terms of the commissioners have largely been coexistent with the rule of the party in power. While beneficial legisla-

[1] Presented by the New England Section Committee on Forest Policy at the Winter Meeting of the Section, held at Boston, February 20-21, 1936.

tion has been secured through the activities of the Massachusetts Forestry Association, this Association, for reasons of diplomacy or expediency, has refused to come to grips with the underlying defect in organization, possibly because under the state constitution they saw no means of remedying it. As long as the present system remains, intelligent progress in this state will continue to be handicapped and retarded as it has in the past, by the inability of these successive commissioners to function properly in their dual capacity.

While Rhode Island has given more attention to conservation problems during the past several years than ever before because of the activities of certain forestry-minded individuals, politics still prevents any lasting progress. A large Department of Agriculture and Conservation has been established, but most of the positions have been filled with individuals having political backing. There is no technical forester at the head of the conservation program.

In Maine, a fairly satisfactory, though not very progressive, status quo was maintained by direct appointment of a Forest Commissioner as long as Mr. Violette was alive. With his death, the subsequent appointment was made without regard to the personal experience of the candidate for the job in question, and the inherent weakness of the system was thus revealed. In the face of such conditions, there is nothing that the subordinate technical force can do about it except to uphold and even praise the new appointees as being men of sound business judgment, good intentions, and great ability; and then hope for the best. Reform, if it comes at all, must be a response to an awakened public sentiment, formulated by well informed persons within the state with the determination to end this inefficient system and insist upon safeguarding the basic resources of the state. It is comparatively useless even for the New England Section of the Society to attempt to bring about these changes within any of the component states, since "outside" interference or suggestions are resented, and the more provincial the state or the more serious the situation, the greater the resentment.

It is therefore up to the foresters and forestry associations in these states to take this initative and stage the battle. Unsatisfactory and wasteful policies and administration cannot be tolerated much longer either in New England or elsewhere. Sound principles of organization are the inherent right of the public, and if led by intelligent and informed individuals or associations who are not afraid of consequences to themselves, these principles can be successfully established throughout New England.

Signed:

A. C. Cline,
E. C. Hirst,
G. T. Carlisle,
A. W. Hurford,
H. H. Chapman, *Chairman.*

New York State College of Forestry Celebrating its Twenty-fifth Anniversary

The New York State College of Forestry at Syracuse University, founded in 1911, is celebrating this year its twenty-fifth anniversary with a series of observances. The first observance occurred April 24, when the alumni of the metropolitan district around greater New York held a meeting attended by 150 graduates, a number of the college faculty and trustees, and guests. The principal talks were made by Chancellor Charles W. Flint, former Dean Hugh P. Baker, President of Massachusetts State College, Trustees J. Henry Walters and George Sisson, Jr., and Dean Samuel N. Spring. A portrait in oil of Dean Franklin Moon by an alumnus, Ernest H. Osborne, '20, was unveiled.

April 29 a two-hour convocation of the

student body of the college was held in the assembly hall of the Louis Marshall Memorial Building, one of the college buildings on the campus at Syracuse. A week later two large white cedar trees purchased by the faculty and student body were presented as a twenty-fifth anniversary gift, and were planted by the students on the campus. A big alumni reunion will be held in the fall, two nights before the Syracuse-Colgate football game.

New Standards for the Measurement and Assortment of Wood in Germany[1]

Those who have been or are interested in price statistics for German forest products will welcome a recent decree of the German government establishing a national uniform method of measurement and classification for forest products which are sold on the market. (This applies to any and all sales of felled wood.)

The Reichsforstmeister, in announcing the decree, issued on April 1 by Reichminister Göring, made the following statement:

"On and after October 1 of this year (1936) a standard procedure shall apply to all fellings throughout Germany, including public and all private and municipal forests, in so far as sales on the market are concerned. All of the various provincial regulations and the customs of individual municipalities and p r i v a t e woodlands are abrogated in favor of a unified, obligatory procedure. This is an important essential for the ultimate organization of the German wood market. It now will be possible to make precise price comparisons, to provide accurate price supervision, and to work out a unified price and sales policy. This most important standardization decree shows how, step by step, progress has been made in the development of forestry and the wood trade; and in this connection, the remarkable thing is that what formerly appeared as impossible of attainment, and was so announced by many, has progressed with steadfast certainty to the goal which was set."

The desirability of having a uniform standard has long been recognized because it has not been possible, in the past, to make a uniform and comparable set of price statistics for Germany, as a whole, due to the differences in measurement which existed in various parts of the country. It has now become a necessity for the proper enforcement of the price supervision and market control policy which the present government has inaugurated.

Formerly wood classification in the forest varied in the different states; and likewise, wood trade in each district used varying standards based upon use.

The new standards classify wood (a) on the basis of conversion, into Derbholz and non-Derbholz, and (b) on the basis of use, as work-wood (Nutzholz) and fuelwood.

Three quality classes for work-wood and poles are recognized, namely, A, B, and C; and these are again subdivided into 6 groups for logs, on the basis of mid-diameter inside bark, and 8 groups for poles, based on diameter and length. Fuelwood is classified in four grades, namely, split wood, knotty wood, round wood, and culls. Likewise, there are special classes for mining timbers, crossties, and pulpwood, as well as for tanbark, fuel bark, and stump wood.

The measurement of the volume of logs is based on length and calipered middle d.i.b., with a trimming allowance which may not exceed 1 per cent of the

[1] For the detailed specifications see "Verordnung über die Aushaltung, Messung und Sortenbildung des Holzes in den deutschen Forsten, Der Deutsche Forstwirt," Berlin, April 17, 1936, pp. 385-389.

length but in no case more than 10 cm except in the mountain regions, where a greater trimming length may be permitted. Fractions of a centimeter are disregarded in diameter measurements. Poles are measured d.o.b. at one meter above the larger end. Stacked Derbholz (both work-wood and fuelwood) may be scaled with or without bark, in stacked meters, with an excess height allowance of 4 per cent for shrinkage. Fagots may be scaled in stacked meters, or estimated on the basis of bundles or other prepared units or in unprepared lots. Stump wood, when split, is measured in stacked meters; when unsplit, the volume is estimated. Bark is scaled on the basis either of weight or of stacked meters.

R. C. Bryant,
Yale School of Forestry.

Red Squirrel Damage to Pine and Spruce Plantations

The past winter was marked by a heavy snowfall which blanketed the ground to a depth of 11 to 18 inches, and which persisted until March. Because of this, red squirrels were unable to find sufficient food of their customary diet and were forced through necessity to eat the dormant buds from several species of conifers. Early in March a survey was made of 10 plantations at Storrs, Conn., belonging to the Department of Forestry of the Connecticut State College.

The first area investigated consisted of about 4 acres of side hill, planted in 1916 as an experimental area containing 5 different species in blocks of pure stands. On three sides the area is bounded by plantations of mixed white and Norway pine; an open field is on the fourth side. Each block was gone over and 100 trees were counted, taken as they came, and their condition was noted. Those trees which had the terminal bud destroyed were recorded as damaged. The following results were obtained:

Species	Damaged	Undamaged
Norway spruce	77	23
White spruce	53	47
Red spruce	29	71
Japanese red pine	—	100
Japanese black pine	—	100

The plantations of white and Norway pine bounding the area were not damaged.

A small plantation of white spruce and Norway pine was found to have both species affected, to the degree shown below:

Species	Damaged	Undamaged
White spruce	30	70
Norway pine	14	86

An area consisting of Norway pine only, some distance from the foregoing plantations, was found to be damaged to a much greater extent. These trees had been planted under a hardwood cover. Results:

Species	Damaged	Undamaged
Norway pine	54	46

On the final area every tree was examined and a more detailed report was made. This plantation was 1½ miles from the others, in a meadow on the west bank of the Fenton River, and was made up entirely of white spruce. The following results were obtained:

	Number of trees	Percentage
Terminal bud and some laterals gone	1,130	74.1
Terminal bud only	35	02.3
Some laterals—no terminals	20	01.3
Undamaged	340	22.3
Total	1,525	100.0

From these data it is concluded that during winters of deep and prolonged snow-cover, red squirrels will feed upon the buds of certain conifers. Norway and white spruce seem to be more heavily damaged, although Norway pine when planted in pure stands surrounded by hardwoods is also damaged. White pine, Douglas fir, and the exotic Japanese red

and Japanese black pines are free from red squirrel damage on the areas examined.

ARTHUR C. HART,
Connecticut State College.

PREPLANTING TREATMENT OF BLACK CHERRY SEED

A series of small plots were laid out in the Wooster, Ohio, nursery to determine the effect of different types of treatment on the seeds of black cherry (*Prunus serotina*). Five lots of fruit, all taken from a common pile, were subjected to different methods of treating as follows:

a. Fruits were placed in a pail of water in a warm place and allowed to ferment until the pulpy seed coats were sufficiently softened to allow them to be removed easily. This was done by rubbing them over hardware cloth fine enough to prevent the seeds from passing through, and washing the pulp through the screen with a stream of water. This method produced seed that was practically entirely free of pulp.

b. Another lot of fruits were fermented, but were unmashed and unwashed.

c. Lye was added to one lot that was being soaked.

d. Raw, unfermented fruits were mashed to free the seeds from the pulp, but were not washed, pulp being sown with the seeds.

e. Raw fruits were untreated in any way.

The seeds from these different lots were sown in the fall of 1935 in the seed bed in plots 2 x 4 feet. Although exactly the same number of seeds were not sown in each plot, an effort was made to approach this so far as possible with the pulpy masses.

Germination began April 25, 1936, and on May 6 the following results were observed:

a. Fermented cleaned seed was germinating well and uniformly. This type of treatment had been replicated, as a check, in alternate plots.

b. Fermented unwashed seeds were germinating at about the rate of 70 per cent of the rate of the check plots, i.e., method a.

c. Lye-treated seeds were germinating much more slowly, at about 50 per cent the rate of the checks.

d. Seeds from raw, mashed but unfermented fruits were germinating very much more slowly, at perhaps 25 per cent of the check rate.

e. Raw seed was germinating at about the same rate as the raw mashed seed.

On May 20 the germination had proceeded to a point where the plots were no longer significantly different. The lye-treated plot was perhaps somewhat lighter than the others, but the raw seed and the raw mashed seed plots had germinated uniformly well and had reached the fermented, cleaned seed plots in numbers of seedlings.

It appears from the results shown by these plots that it is unnecessary to treat the black cherry seed in any way to secure adequate germination. However, if early germination is advisable, fermenting the seed before sowing will be effective. The additional gain secured by cleaning the seed probably does not justify the labor expended in this cleaning.

R. R. PATON,
Ohio Division of Forestry.

REVIEWS

Forest Bibliography with the Index Number 634.9 F.: An International Decimal Classification on the Basis of Melvil Dewey's System. By Bibliographical Committee, International Union of Forest Research Organizations. *vii + 100 p. Imperial Forestry Institute, Oxford. 1936.*

This publication is the result of the labors of an International Union Committee entrusted at Mariabrunn in 1903 with the preparation of a general forestry bibliography. Four members of the original committee died before seeing their work completed. The present committee consists of Prof. R. S. Troup (England), Chairman; Prof. W. Jedlinski (Poland), Prof. H. Perrin (France), Prof. H. Weber (Germany), and Dr. Ph. Flury, (Switzerland), Secretary.

An introduction by Prof. G. Roth, President of the Union, indicates that the original ambitious plans to create an international secretariat of forestry bibliography in Switzerland and to go back to 1750 in the compilation of the bibliography have had to be discarded, owing to the general economic crisis. For the present, attention will be confined to the current literature.

The classification scheme for forestry, which covers 51 pages, shows the results of the painstaking efforts of Dr. Flury, who did much of the actual work. The scheme proper is preceded by a brief historical review and a guide for its use, with explanations of the bibliographical system, the application of the decimal system, the maintenance and employment of the literature cards, and the conversion of previously existing bibliographical systems into the decimal classification. In spite of the attempt to minimize the difficulties involved in changing to the decimal system, the expense incident to reclassifying many thousands of cards will be prohibitive for many forestry libraries in the United States. Twenty years ago the Librarian of the U. S. Department of Agriculture made this very clear to the reviewer. The situation would be even more difficult today, owing to the many accessions since then. The difficulties in changing a bibliographical card file would be not nearly so great as those resulting from the changing of a library classification and shelving scheme.

A useful geographical index and an alphabetical index essential to the use of any extensive classification scheme complete the volume.

The report was first published in German,[1] and the English translation was prepared by the staff of the Imperial Forestry Institute, Oxford. The translation of technical terms was verified by Dr. C. A. Schenck.

The scheme contains many headings which will not be needed in the United States for many years. All of us who have had anything to do with the preparation of compilation or classification

[1]Forstliche Bibliographie des Internationalen Verbandes forstlicher Forschungsanstalten nach den Grundsätzen der Melvil Dewey'schen Dezimal-Klassifikation. Mitt. Schweiz. Centralanst. Forstl. Versuchsw. 18:417-547. 1934.

schemes realize that no two people will prepare the same identical scheme independently, and that to develop a generally satisfactory scheme much compromising will be necessary. Perhaps the most disappointing feature of the whole scheme to us in North America is the omission of adequate provision for the various phases of range management and their coordination with forest management, which is very essential in many sections of the United States. The necessity for these topics was fully stressed in the classification scheme developed some years ago by a committee of the Society of American Foresters.[2] This need was also called to the attention of at least one member of the international committee. The nearest approach to "Range management" appears to be "Pasture forests."

A number of errors, presumably typographical, tend to mar the otherwise pleasing appearance of the topography. For example, we find 634.9241, "Clearings" for "Cleanings," and 634.96551 "According to value" instead of "According to volume."

Several expressions are used which unfortunately we Americans will be unable to understand fully. It is difficult to rationalize "education of stands" as being synonymous with "tending of stands." Even to one only moderately acquainted with European conditions, it is difficult to understand why "soil improvement by burning forest or debris" should fall under "forest constructional works" along with building, road, and bridge construction, rather than under "silviculture." "Forest management plans" would be a better term to use in place of "forest working plans," to avoid confusion with working plans for various other forestry projects.

The work under review presents good argument for the need of further progress on the standardization of forestry terminology among the different countries, especially those using the same language. At least some of the differences in terminology between countries could be overcome by having a more complete subject index, which would include more synonyms than the present one contains. With a number of desirable changes such as those indicated, the scheme could easily be made applicable to North American conditions.

C. F. Korstian,
Duke Forest, Duke University

Progress Report of the Forest Authority for Palestine. *16 pp.* **Supply, Consumption and Marketing of Timber—Palestine.** *14 pp.* **Exotics in Palestine.** *15 pp. Dept. of Agric. and Forests, Palestine. Jerusalem, 1935.*

The present status of forestry in Palestine is outlined briefly in these reports, prepared for the British Empire Forest Conference of 1935. The rapid population growth and the agricultural and industrial development of recent years have been accompanied by a great increase in timber requirements, which have to be met almost entirely by importation because most of the usable timber in Palestine was cut or destroyed during the War.

Total annual expenditures for forestry average about £18,000, which is about one-seventieth of the value of timber products imported in 1935 and less than one-fifteenth of the sum spent for imported citrus boxes alone. The Forest Service consists of two technically trained senior officers, 48 rangers and guards

[2]Korstian, C. F., A. B. Recknagel, and John Briscoe. An outline for the classification of forestry literature. Jour. of For., 21:148-161. 1923.

without special forestry training, and several surveyors, gardeners, and clerks. The personnel and expenditure do not seem so small, however, when one reads that the total forest area, much of which is not covered with trees, is only 500 square miles.

One of the principal forestry activities is afforestation. Numerous exotic species are employed, chiefly pines, cypresses, acacias, eucalypts, and casuarina, and including such American trees as Arizona cypress, black locust, mulberry, and *Parkinsonia*, and even bald cypress in swampy spots. Some 12,000 acres of plantations have been established.

Severe droughts during the period 1931-1934, accompanied by extensive wind erosion and followed by heavy rains and flood erosion in 1934-1935, have emphasized the need for protection forests.

It is interesting to note that, with an expenditure for silvicultural research in 1935 amounting to only £96, the problems under investigation included: introduction and trial of exotics, nursery and planting practice, erosion prevention, pasture improvement and management, dune reclamation, planting in arid districts, thinning, and botanical and ecological studies.

W. N. Sparhawk,
U. S. Forest Service.

Report on Wood-Using Industries in Canada, 1933. By L. J. Pouliot, under direction of R. G. Lewis. *142 pp. Dominion Bureau of Statistics, Forestry Branch. Ottawa, 1936. Price 25c.*

This report combines, with fuller detail and supplementary data, the information hitherto presented in summarized form in 14 mimeographed reports on 15 groups of industries. Although consuming only about 10 per cent as much timber as the corresponding industries in the United States, the Canadian wood-using industries occupy an important place in the economic structure of the country. In 1933 they used a little more than 500 million board feet of lumber, bolts, veneer, and plywood, valued at 14 million dollars; employed an average of more than 23,000 persons; and turned out products worth 52 million dollars.

Sash, doors, flooring, planing mill products, and containers accounted for three-fourths of the wood consumed; but the leading industry in numbers employed and value of product was furniture manufacture, which overtook sash, doors, and planing mill products in 1930. The report states that the furniture industry depends chiefly on the United States and the Tropics for its raw material, owing to the virtual exhaustion of domestic supplies of the more valuable woods such as white oak, cherry, and black walnut.

The authors do not share the opinion that wood is on its way out as an important industrial raw material, but point out, on the other hand, that extensive use of so-called substitutes has in some instances led to an increase in the general consumption of wood. Regarding the relation between demand for wood and use of substitutes they observe: "The use of substitutes for wood may tend to reduce consumption, but this is usually exaggerated as a factor in forest conservation. The increasing scarcity of wood will result in increasing prices, which will tend to limit consumption."

W. N. Sparhawk,
U. S. Forest Service.

Photographic Illustrations of the Crown Forests. By Department of Crown Forests and Estates in the Imperial Household (Japan). *In Japanese. 32 + 316 Pp. Illustrated. 1934.*

The Japanese Crown Forests belong to the Imperial Household, not to the state. They aggregate close to three million

acres, or about 3 per cent of the forest area of the entire country, including dependencies. They consist, for the most part, of conifers and broadleaved species of the temperate zone. They are divided into some 244 ranger districts, and are managed by a forest department entirely distinct from that of the state. This department has its own experiment station and research staff, and publishes the results of its work.

The present volume, which is largely pictorial, consists of 348 excellent halftones, each with a brief descriptive text. Included are many views of natural and artificial forest stands, natural reproduction and nursery work, logging and transportation, engineering projects, experimental work, fish culture, charcoal and byproduct manufacture, famous big trees, and use of wood in building. These appear to give a very good picture of the Imperial forests and their administration and utilization. It is unfortunate, at least from the standpoint of westerners, that a brief explanation in English or some other western language does not accompany each illustration. This would add much to their interest.

W. N. SPARHAWK,
U. S. Forest Service.

A Mycorrhiza-Forming Fungus of Pinus. By E. H. Young. *Jour. Australian Inst. Agric. Sci. 2:32-34. 1936.*

This paper contains the second (see JOURNAL OF FORESTRY, January, 1936) report of the current year which supplies experimental evidence that trees depend on symbiosis with mycorrhizal fungi for their very existence. The author writes: "Seedlings of *Pinus caribaea* and *P. patula* growing in pots were inoculated with a culture of *Boletus granulatus*. . . . The growth response was remarkable. The inoculated pots showed little or no growth and finally died, whilst those inoculated grew vigorously and the foliage became a green, healthy color. The foliage of the controls was of a purplish red color. Typical mycorrhizae developed in the inoculated pots."

The body of the paper is concerned with a demonstration, by a simple soil culture technique, that *Boletus granulatus* produces mycorrhizae in Queensland with *Pinus taeda* (previously accomplished by Doak in America), *P. caribaea*, and *P. patula*.

In common with nearly all students of tree roots, the author believes that infection of roots leads to a reduction of growth. "The fungus appears to prevent any great increase in length." Actually the two types of roots in pine (short-roots and long-roots) are inherited, and the shortness of short-roots, the only roots which normally become mycorrhizal, is in no way caused by infection. Rather, mycorrhizal fungi stimulate the growth of these roots and greatly increase their surfaces.

Currently the author is engaged in inoculating seed beds with pure cultures of mycorrhizal fungi, a technique for discovering the influence of different species of fungi on the growth and survival of trees which is much needed in America.

A. B. HATCH,
Oregon State College.

Decay Following Fire in Young Mississippi Delta Hardwoods. By George H. Hepting. *32 pp., 4 pl., 6 figs. U. S. Dept. Agric. Tech. Bull. 494. 1935.*

In this bulletin Hepting reports the results of a study made to determine the relation of fire scars and the decay entering through them to mortality and cull in young hardwood stands of the Mississipp Delta. He contributes valuable informa

tion on the susceptibility to injury by fire and decay of the species studied, the organisms responsible for most of the decay, and the rate of healing of fire scars. By means of multiple correlation analysis he determines the relationship between rate of decay and such variables as age, area, and height of fire scar and age and diameter of tree. The application of multiple correlation analysis to data of this type is new and of special interest, for it permits the evaluation of each of the several variables influencing the rate of decay while the remainder are held at their mean values.

Hepting shows that ground fires have been common in the Mississippi Delta for at least 30 years. Widespread burning and damage occurred during the dry seasons of 1917-18 and 1924-25. The species studied did not exhibit any marked difference in susceptibility to fire injury, but healing or callus formation was more rapid for the oaks and red gum than for ash, persimmon, or hackberry. Fire-scarred oaks and hackberry were most susceptible to infection by wood-rotting fungi, whereas ash, red gum, and persimmon were more resistant. The resistance of the last two species is attributed to the formation of wound gum in the xylem cells beneath the scarred surface.

Of particular interest is the occurrence of heartrot in young trees without heartwood. In most regions such trees are generally considered free from heartrot, with decay confined to the surface layers of wood beneath the fire scar. The occurrence of certain fungi in the Mississippi Delta that are capable of attacking dead sapwood, living sapwood, and heartwood with about equal facility, perhaps accounts for these losses in young trees. Once infection through fire scars has taken place, a definite relation exists between rate of decay and age and diameter of tree, percentage of circumference scarred, and the fungus causing the decay. A list of the most important fungi and insects entering through fire scars is included.

Hepting's bulletin is a valuable contribution to our knowledge of timber conditions in an important but as yet little investigated hardwood producing region.

FRANK KAUFERT,
University of Minnesota.

Planting and Care of Trees in South Dakota. By E. R. Ware. *South Dakota State Coll. Extension Service Circ. 356, 56 pp. Illustrated. 1936.*

This valuable and timely circular is the result of the cooperative efforts of the forestation committee of the South Dakota State Planning Board, the South Dakota State College Extension Service, the Regional Forester at Denver, the Plains Shelterbelt Project, the Lake States Forest Experiment Station, and various other individuals and agencies. The large number of cooperators is indicative of the general interest in and importance of the survey.

The publication is a readable and informative treatise on planted groves in South Dakota, as well as on native species. It lists desirable species to use for shelterbelts and windbreaks, according to zonal and local conditions. It is also a practical handbook on tree-planting practices for farms, country schoolgrounds and municipalities. The principal topics covered are: The development of tree planting in South Dakota; present condition of tree plantations; purpose of planting; tree-planting zones and recommended species; planting plans; establishing the plantation; care and protection of plantations; geographic conditions; and description of species.

Of the 35 kinds of trees and shrubs studied in tree plantations, 23 were found to be satisfactory. Besides various decidu-

ous species, eastern red cedar, Rocky Mountain red cedar, and ponderosa pine are listed among the most hardy species for planting throughout the state; Black Hills spruce and blue spruce are adaptable to four of the six zones into which the state (excepting the Black Hills) is divided. It is significant that relatively few of the plantations are of evergreens. Their more general use is indicated by this study.

Following is a summary of facts found by the survey:

Number of plantations in the state:	
Farmstead shelters	38,180
Field windbreaks and woodlots	8,500
School shelters	320
Total	47,000
Area of plantations	86,000 acres
Average size of plantations:	
All plantations	1.83 acres
Farmstead shelters	1.70 acres
Field windbreaks and woodlots	2.45 acres
Range of sizes studied	0.1 to 40 acres
Age of plantations:	
Fifty-one per cent were	30 yrs. or over
Oldest plantation found	80 yrs.
Timber Culture Act plantations:	
Average age	51 yrs.
Oldest found	60 yrs.
Percentage of original number remaining	24
Percentage of original area remaining	12.5
Volume of timber in plantations:	
Total volume	924,000 cords
Average volume per acre	10.7 cords
Annual growth per acre	0.25 to1.0 cord
Annual cut from plantations:	
Fuelwood	50,000 cords
Fence posts	33,000 posts
Lumber	300,000 bd. ft.
Condition of trees in 1935—All plantations:	
Living	55 per cent
With dying top branches	26 per cent
Dead	19 per cent

Forty-six per cent, or less than half, of farm homes have farmstead shelters. One out of every two farms has a tree plantation, and there is 1 acre of planted trees to every 200 acres of crop land.

Only one out of every 14 schools has a tree shelter.

JOHN H. HATTON,
Plains Shelterbelt Project.

The Care and Repair of Ornamental Trees in Garden, Park, and Street. By A. D. C. LeSueur. *xiv+257 pp. Illustrated. Country Life Ltd. London, 1934. Price 10s 6d (American price, including duty, about $3.75).*

This compact and intensely practical manual on tree planting and care is of interest to the American reader familiar with such textbooks of our own as those by Peets, Solotaroff, Fernow, and the federal and state bulletins, mainly because of its English viewpoint and its description of practices in the British Isles. Here is a country which for hundreds of years has developed woodlands of oaks, beeches, and pines, as well as its individual trees, mainly for their scenic and recreational value. Although the English people may not have practiced tree surgery to the same extent as a wealthy American clientele during recent years, they have had more experience in introducing and propagating new varieties of trees, in selecting the proper environment and soil conditions for them, in planting design, and in statutes affecting the tree owner. Specific details are also given regarding methods of planting and tree arrangement on streets, tools and materials used in tree surgery, fungus diseases and insect pests, damage by animals, the age which trees may attain and methods of preserving very old trees, the treatment of backward trees, and the relative suitability of various species for the English climate.

LeSueur, as a result of his years of practical work with ornamental trees under the most difficult city conditions, is able to give sound advice that is very valuable to anyone responsible for the care of trees in parks, grounds, or streets as well as for the interested amateur.

GEORGE A. CROMIE,
Connecticut C.C.C.

CORRESPONDENCE

Editor, *Journal*:

It has just been called to my attention that in the August 2, 1935, issue of *Science* Mr. H. H. Chapman made the following statement in an article entitled, "Shall the Department of the Interior Become the Department of Conservation and Works?"

". . . This article is not a discussion of the reasons why such legislation should not pass, which would occupy more space than is available. They hinge on two points. First, the organic resources, soil, forests, and wildlife, constitute a balanced whole, which can be regulated intelligently only by unified control in the hands of men trained in the fundamentals of biology and administration of such problems. Second, the continuous and continuing record of the Department of the Interior is such as to prevent those who understand these problems from extending their confidence to this Department as the custodian of such resources."

Mr. Chapman in this statement makes a generalized condemnation of the conservation activities of an entire Department. I will not meet Mr. Chapman's sweeping generalities with a counter-generalization, but will instead explain why I consider his accusation to be entirely unjustified as regards the one Interior Department Bureau with the functioning of which I have detailed knowledge.

The Indian Service, in addition to the normal problems of conservation, has a peculiarly difficult problem because the Indians are living all over the forests and range lands of the reservations. It is not possible in critical fire seasons to keep people out of reservation areas as it is in the National Forests. Furthermore, many of the Indian tribes have been using their timber and range in a certain manner long before white men ever came into the country, and they feel that they have a right to use it that same way indefinitely. Every conservation activity which the Indian Service undertakes on any reservation must be explained patiently to the Indians, and many activities require by law the approval of the Indians. Indian Service foresters and range men must be diplomats as well as technicians. They must also function under an appropriation which amounts, per acre of a given type, to less than half of what the Forest Service is getting. In spite of these handicaps, the Indian Service personnel has remained thoroughly loyal, and the men have been so anxious to do good conservation work that they have worked outrageous hours overtime. Great as my admiration for the Forest Service is, I cannot see how a fair-minded person who forms his opinion in actual observance and not preconceived prejudices can credit the Forest Service personnel with any more efficient or intelligent administration than the Indian Service personnel demonstrates on the Indian timber and range lands.

Mr. Chapman's writings reflect not only on the rank and file personnel of the Interior Department conservation bureaus, but also on the higher-ups. As Director of Forestry in the Indian Service, I am thoroughly familiar with how the head of the Indian Service and the head of the Interior Department have handled all conservation matters on which they have had to pass judgment pertaining to Indian

affairs. I can truthfully say that neither Commissioner Collier nor Secretary Ickes has ever objected to a single conservation activity or conservation policy which has been put up to them. Each has backed 100 per cent everything the Forestry and Grazing Division has wanted to do for the sake of bringing about better forest and range management.

I have not touched on the conservation activities of other bureaus in the Department, because I am not intimately familiar with them. However, I do feel that Mr. Chapman's sweeping condemnation of an entire Department is a great injustice to as loyal, competent, and idealistic a group of foresters and range managers as I have ever been fortunate enough to meet.

Sincerely,

ROBERT MARSHALL,
Office of Indian Affairs.

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